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SOME CASES OF OTOLARYNGOLOGICAL INTEREST THAT WERE SEEN ON THE NEUROLOGICAL SERVICE.*†

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In the diseases of the ear, nose and throat, the diagnosis generally is easy in comparison with the difficulty of carrying out a curative treatment. When there is a delay, therefore, in finding out the disease to be treated, the patient does not receive the best of care; for, indeed, appropriate treatment in the early stage of the disease may be necessary to lifesaving. In the following report of cases the delay in making a correct diagnosis resulted from either our failure to make a painstaking ear, nose and throat examination, or our not believing that the symptoms present were caused by the disease of the patient, or our errors, factual or interpretative, in the laboratory test.

Case 1: Retrobulbar neuritis, right. Sinusitis. Incorrect diagnosis: Tumor of right orbit.

A housewife, age 34 years, was complaining of total loss of vision of the right eye. The blindness had been progressive, beginning three weeks past. She was sent to the hospital, with the diagnosis of tumor of the right orbit, which

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was made on the evidence of the ophthalmologist's report of lack of light perception, no intraocular disease, slight restriction of bulb movements, right eye; and Roentgenogram signs of an erosion of the corresponding greater wing of the sphenoid bone. The neurological investigation didn't disclose any abnormality except the blindness of the right eye.

Inspection of the nose found mucoid pus coming from the maxillary and ethmoid sinuses on both sides, and from the right sphenoid sinus. On May 10, 1932, under local anesthesia, on the right side intranasally, a large opening was made into the maxillary sinus, the posterior half of the middle turbinate was removed, the opening into the sphenoid sinus was enlarged and some of the posterior ethmoid cells uncapped. Mucoid pus was found in all of these sinuses and it was under pressure in the sphenoid. The operation was followed by daily irrigations of the sinuses until the infection subsided.

Right eye examination after operation: Ten days: the nasal peripheral visual field was returning; 15 days: the entire peripheral visual field was returning; 21 days: the visual acuity was 3-200, peripheral fields were normal, a central scotoma for white was present; three months: the visual acuity was 20-30, entire visual field was normal excepting a small scotoma for red and green around the blind spot; five years: the visual acuity was 20-20, there was a very small scotoma for red and green around the blind spot.

Case 2: Cerebral tumor. Incorrect diagnosis: Retrobulbar neuritis.

A female nurse, age 21 years, complained of bilateral impairment of vision, diplopia, headaches, "pounding" in the ears and vomiting. Those symptoms appeared four days past and had become more intense. She had an acute upper respiratory infection, with slight fever one month before the onset of the present illness. The patient was ambulatory and did not appear to be acutely ill.

The report of the eye examination was: Half normal visual acuity in both eyes, slight swelling of both nerve heads and weakness of the right external rectus muscle. The Roentgenogram showed moderate cloudiness of both maxillary sinuses and probable cloudiness of both sphenoid sinuses.

Those findings had prompted the diagnosis of bilateral retrobulbar neuritis. The ear, nose and throat examination disclosed a small amount of mucoid pus in both maxillary sinuses. Although on inspection there was no evidence of infection of either the posterior ethmoid or sphenoid sinuses, the sphenoid sinuses were irrigated with a clear return. A few days later the neurological investigation resulted in an operation which showed that she suffered of a large, deep-seated, parietal lobe tumor.

Comment: The patient in Case 1 is the aunt of the patient in Case 2, and they had the same family physician, ophthalmologist and Roentgenologist. In the first patient the incorrect diagnosis was caused by the misleading interpretation of the Roentgenogram—an erosion of the greater wing of the sphenoid bone—and the failure to look for sinusitis as the cause of the eye disorder. Retrobulbar neuritis is caused very seldom by a sinus infection; the probable incidence is less than 1 per cent. Many patients with retrobulbar neuritis that were operated on for so-called hyperplastic sinusitis later were discovered to have had some other cause for the optic nerve disorder; notably, multiple sclerosis. The severe sinus infection in this patient warranted irrigations and probably the operation would have been necessary in the treatment, even if there had not been the eye complication. She has been in good health for about five years after her recovery from the sinus infection.

In Case 2, a reasonable valuation was not made of the symptom of swollen optic nerve heads. When a patient has papilloedema the only acceptable diagnostic procedure is that of an investigation for other symptoms of an expanding intracranial lesion before attributing the cause to any other disease. Cloudiness of some of the sinuses in a Roentgenogram should not be misleading, although there are reports in the literature of papilloedema, allegedly produced by sinusitis. Indeed, in a few patients observed by me a papilloedema appeared and disappeared without any cause, discovered on a painstaking investigation, of its presence.

Case 3: Carcinoma of the nasopharynx. Incorrect diagnosis: Gradenigo's syndrome from an atypical ear infection.

A housewife, age 28 years, had intermittent pain and buzzing in her right ear, beginning three months past. There

was a doubtful history of middle ear discharge during that time. Pain about the ear had increased and it radiated to the temple and at times to the occipital region.

Neurological examination report: "Diminished sensation to pin prick of the second and third divisions of right Vth nerve. At times there seemed to be a slight increase of deep reflexes on the left side. Right abdominals were always greater than the left. Sensations on anterior two-thirds of tongue were diminished on both sides." Later she developed weakness of the right external rectus muscle. The Roentgenogram showed cloudiness, but no breaking down of septae of the cells of the right mastoid. The temperature was not over 100° during the observation period and the blood cell count was within normal limits.

She had a moderate impairment of hearing, conductive type, in the right ear. The vestibular reactions were normal. The right eardrum was full in the upper part and slightly reddened. There was no tenderness in the mastoid region.

The diagnosis was made of Gradenigo's syndrome, with an unusual middle ear and mastoid infection that only produces slight inflammatory changes in the drum membrane and evidence of slight mastoid involvement on the Roentgenogram. A myringotomy, however, did not disclose any infection in the middle ear. A Roentgenogram of the base of the skull showed a large irregular defect in the floor of the right middle fossa, involving the inner anterior portion of the petrous pyramid. After the diagnosis of tumor of the base of the skull was made from the Roentgenogram, the first satisfactory inspection of the nasopharynx was made. That disclosed a large soft tissue mass that bled easily, extending from the opening of the right Eustachian tube upward and backward to the vault.

It was a carcinoma that responded satisfactorily to X-ray therapy.

Case 4: Carcinoma of the nasopharynx. Incorrect diagnosis: Sphenopalatine ganglion neuralgia. Chronic tonsillitis.

A male clerk, age 33 years, was complaining on admission to the hospital of a pain in the left side of face and head, moderate loss of hearing in the left ear and double vision.

The year past he had some pain in the left ear, no discharge, and since that time intermittently there had been "stuffiness" and noises. He had considerable discomfort, beginning about nine weeks past, from pain in the left side of face and head, and had an occasional blood-tinged discharge from the left nostril. At that time the left sphenopalatine ganglion was injected and after two weeks his tonsils were removed. Neither of these operations produced any relief from the pain. The day following the tonsillectomy he had double vision for the first time.

Paralysis of the left external rectus muscle was the only neurological finding of significance.

The Roentgenogram report was: "The entire left mastoid region is undergoing sclerosis; evidently as a result of a chronic infection, the left sphenoid is cloudy; whether this is due to tumor or not I am unable to say."

Through a nasopharyngoscope an irregular soft tissue mass was seen extending from the orifice of the left Eustachian tube upward and backward, and mucoid pus was seen coming from the left sphenoid sinus. The left eardrum was red along the handle and in the upper part, and retracted; and there was a moderate impairment of hearing, conductive type. It was a carcinoma that did not respond to X-ray therapy.

Case 5: Lymphoepithelioma of the nasopharynx. Incorrect diagnosis: Tonsillitis. Acute catarrhal middle ear infection.

A boy, age 11 years, was admitted to the hospital for an investigation of his condition, because his mother observed that for the past two months he was apathetic and not inclined to play with other children, did not sleep well, was losing weight and complained of headaches. On the general examination the patient co-operated well, but appeared to be disinterested in the surroundings. There was tenderness over the left mastoid and moderate impairment of hearing on that side. Cervical glands were palpable on both sides, left larger than right. He appeared to be chronically ill.

During the observation of 10 days his temperature was not over 100°. White cell count was 8,750; with polymorphonuclear neutrophils, 70 per cent; eosinophils, 2 per cent;

lymphoyctes, 38 per cent. There was a slight cloudiness of the cells of the left mastoid on the Roentgenogram. The first ear, nose, throat examination report was: "Large adenoids, tonsils medium size, left larger and subacutely inflamed, lymphoid pharyngitis. Acute catarrhal otitis media, left. Ear symptoms secondary to inflamed left tonsil and may subside on abatement of tonsillitis." Not until the fourth otolaryngologist examined the patient was the disease present suspected. His report was: "Soft palate immobile on the left side, large irregular mass, resembling adenoids, filling left nasopharynx, left drum retracted and slightly injected in upper part, left hearing moderately impaired, no mastoid tenderness. In spite of mastoid cloudiness don't operate. Remove tissue mass in nasopharynx and get microscopical examination."

It was a lymphoepithelioma and responded satisfactorily to X-ray therapy.

Comment: In the last three patients the diagnosis depended neither on recognizing the symptoms of some rare disease nor on interpreting exceptional symptoms in a fairly common disease. In the adults a satisfactory inspection, on the original examination, of the nasopharynx indirectly with a mirror or directly with a nasopharyngoscope would have disclosed a new growth. In the boy the disease would have been discovered earlier if recognition had been given to the long acceptable observation that unilateral disease of the pharynx is not caused by the ordinary infections of the throat. The three case reports show that neither is a satisfactory examination of the ear, nose and throat always made, nor are the usual symptoms of tumors of the nasopharynx always kept in mind by experienced otolaryngologists.

Case 6: Trichinosis. Incorrect diagnosis: Sinusitis with orbital cellulitis.

An engineer, age 33 years, was complaining of swelling of both the right eyelids, headaches and fever. These symptoms had persisted for 10 days. The headache was severe at times, and the temperature daily was 100° to 102.5°. There was no improvement in his condition with treatment for suspected sinusitis, consisting of argyrol tampons and nose drops.

The general examination of this patient did not discover the cause of his symptoms. The report on the blood cell count was 8,000 leukocytes, with polymorphonuclear neutrophils, 65 per cent; eosinophils, 3 per cent; basophils, 2 per cent; lymphocytes, 30 per cent.

On examination there was swelling of the eyelids of both eyes, but considerably more on the right. The conjunctiva was red in both eyes. There was no redness, tenderness or fluctuation of the eyelids. There was no disturbance of vision, no proptosis and no limitation of eye movements. He complained, however, of slight pain in the eyes on lateral gaze. The nares were clean and the frontal and maxillary sinuses were clear on transillumination. He was transferred from his home to the hospital, with much speculation as to the cause of his disability. A normal total white cell count with 33 per cent eosinophiles, which was in contrast to the normal differential count reported 24 hours before, led to the correct diagnosis. He recovered under the treatment of his family doctor in his home.

Case 7: Cerebrospinal syphilis. Incorrect diagnosis: Frontal sinusitis. Osteomyelitis of frontal bone.

A laborer, age 30 years, was admitted to the hospital two months following a depressed fracture of the right frontal sinus plate. His only complaint was a severe headache of two weeks' duration. A depressed fracture could be seen, as well as felt, just above the right eyebrow. The skin was intact and was not inflamed. The general neurological investigation, including spinal fluid examination, did not disclose any abnormal finding other than slight personality changes. Temperature was from 100° to 102°. Roentgenogram only showed a depressed fracture of the anterior plate of the right frontal sinus.

It was thought that he was developing an intracranial complication of a sinus infection, following the fracture. Under general anesthesia the usual frontal sinus incision along the upper margin of the right eyebrow was made. The periosteum was elevated and appeared to be normal. The fragments of depressed bone were removed and the sinus inspected. There was no sign of a blood clot or infection present and the posterior wall was normal in appearance. Primary closure of

the incision was made. Two days later, the spinal fluid Wassermann was reported as 4+, although a week before, from a different laboratory, the test was reported as negative. He responded to treatment for cerebrospinal syphilis.

Comment: The fallibility of reports on laboratory tests is shown in the above two cases. The error in the blood count resulted in admitting to the hospital the patient with trichinosis, which should have been as easily diagnosed and as effectively treated in his home. The patient with a fracture into the frontal sinus had cerebrospinal syphilis that accounted for his symptoms. In spite of this error in diagnosis, due to the spinal fluid Wassermann test reported as negative, more lives would be saved if it were usual to open every frontal sinus involved in a fracture as soon as possible after the injury. Many patients with fractures of the anterior frontal sinus wall have fractures also of the posterior wall that are not demonstrated in the Roentgenogram and subsequently they develop a brain abscess or meningitis. The presumable course of events is extravasation of blood into the frontal sinus, at the time of the fracture, which becomes infected through the sinus opening into the nose producing an intracranial infection. No ill consequences should come from opening a normal sinus, and if a blood clot or injury to the posterior wall is present, it can be appropriately treated. One patient was seen that had his first symptoms of a frontal lobe abscess two years following such a fracture.

Case 8: Acoustic neuroma, right. Incorrect diagnosis: Brain stem lesion.

A man, age 40 years, gave a history of headaches for the past six years. Noises in the right ear were first noticed two years later, which disappeared after some months, leaving him with some deafness in the right ear. For the past five months there was progressive loss of eyesight in both eyes. At infrequent times there were slight dizzy attacks.

The diagnosis of a right acoustic neuroma was made on the findings of the neurological examination, along with the Roentgenogram, and verified on operation.

No ear, nose or throat disease was disclosed on examination. The cochlear tests showed a loss of hearing in the right ear of about 35 sensation units for all of the tones on the

audiometer, and bone conduction was longer than air (256 fork). The hearing was normal in the left ear. The vestibular reactions to rotation and caloric testing showed normal quantitative responses on both sides, but on the right side caloric testing there was a qualitative change in the nystagmus reaction, in which the nystagmus was oblique instead of horizontal in the face-up position. In the functional ear examination the findings suggested a conducive impairment of hearing in the right ear and a brain stem lesion.

Comment: In the examination of 30 patients with verified acoustic neuromas, this is the only one that had either nystagmus, vertigo or pastpointing after irrigating the ear on the side of the tumor with water at 67° for five minutes. An enlargement of the right internal auditory opening appeared definitely on the Roentgenogram.

Case 9: Total loss of cochlear and vestibular function. Traumatic. Incorrect diagnosis: Malingering.

A laborer, age 38 years, compensation case, complained of total deafness in the right ear following a head injury one year past. The history of his condition just following the injury was conflicting in many respects, but it seemed certain that he was unconscious for a few minutes and had vertigo for a few days after regaining consciousness. The history included a report of no bleeding from the ears. Disability for total loss of hearing in the right ear had not been allowed by the court.

The general neurological investigation did not disclose any abnormal condition, except probable loss of hearing in the right ear.

There were no objective symptoms of any disease of the ear, nose or throat on physical examination. Cochlear tests showed the hearing to be normal in the left ear and no admission of hearing any tones in the right. Tests did not reveal malingering. The vestibular reactions were normal on the left side and negative on the right.

Comment: It was necessary to give an opinion on whether this patient was malingering, and, if not, what was the degree of loss of hearing in the right ear. Although he claimed total deafness and the tests for malingering were not positive, the

most conclusive evidence of his having unilateral total loss of hearing was the absence of vestibular reactivity on the right side. I have never seen a patient with a traumatic ear lesion resulting in absence of vestibular reactivity that had definite evidence of retaining any cochlear function. This patient is one of the many, who have been examined, with the complaint of unilateral deafness that important diagnostic evidence was obtained by the vestibular tests.

Case 10: Ménière's syndrome from obstruction to Eustachian tube: 1. Hypertrophied adenoids and tonsils; 2. Temporomandibular joint relaxation.

A storekeeper, age 38 years, when first seen had suffered of spells of dizziness, with nausea and vomiting, for nine months. He was unable to carry on with his work. He had progressive loss of hearing and tinnitus in the right ear for 15 years. There had been no ear infection. A neurological investigation, including spinal fluid examination, did not disclose any abnormal finding.

On examination the ears appeared to be normal and the sinuses normal, but the tonsils and adenoids were large and moderately injected. The adenoids on the right side were against the lip of the opening of the Eustachian tube. The loss of hearing in the right ear was about 55 per cent. The hearing in the left ear was normal. The vestibular reactions were normal on both sides. There was no spontaneous vestibular disturbance present. He felt better after inflating the right ear. After removing his adenoids and tonsils he was free of dizzy spells and tinnitus, and his hearing loss in the right ear was reduced to 25 per cent.

After having been free of his complaint for five years there was a recurrence. A month before this, all of the lower right molars had been extracted. There was no demonstrable disease of the ears, nose or throat, except lack of patency of the right Eustachian tube. On the restoration of his molars, again there was relief from his tinnitus and dizzy spells, which has lasted throughout the past year.

Comment: This seems to be a case of Ménière's syndrome resulting from lack of patency of the right Eustachian tube from adenoids and later by relaxation of the right temporomandibular joint.

The effectiveness of measures to diminish the sodium in some patients with Ménière's syndrome has led to a very general use of such treatment, on the unwarranted assumption that a disordered water metabolism is responsible for this disability in all patients. Since this disturbed cochlear and vestibular function may be caused by any one of many pathological conditions, located extra- or intracranially, a searching neurological and otological examination should be made in each patient before instituting treatment directed at a speculative etiology.

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ABSCESS OF THE EPIGLOTTIS. REPORT OF TWO CASES.*†

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We have recently had the opportunity of observing two cases of abscess of the epiglottis that ran parallel courses, lasting but a few days and ending in complete recovery. While observing and studying these patients, we consulted in moderate detail the standard textbooks and writings of authorities in this field, only to find scant reports of such cases. Our aim, therefore, is to report these cases and comment on them, in the hope that rational conclusions will be drawn regarding the management and cure and the prevention of dangerous, if not fatal, complications.

Case 1: J. O., male, age 26 years, shoe salesman, was admitted to the Bronchoscopic Clinic of the Graduate Hospital of the University of Pennsylvania, on the evening of Nov. 7, 1936, with the following history: difficulty of swallowing and a sense of fulness and tension in the hypopharynx of 24 hours' duration. He had eaten a very light dinner the previous evening and suddenly noted for the first time that there was a little difficulty in swallowing. He was not dyspneic nor cyanotic. His family history and previous medical history is of no importance. A general tonsillectomy was performed in this hospital on Oct. 8, 1936, with no complications, and the fauces healed satisfactorily in a very short time. There is no personal or family history of allergy.

The general examination disclosed a fairly well nourished adult, not acutely ill, not dyspneic nor cyanotic. The head, chest, abdomen and extremities were essentially negative. Examination of the pharynx revealed clean fauces, and indirect laryngoscopy disclosed a swelling of the epiglottis at the apex of the free lingual surface, with a yellow spot.

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The right aryepiglottic fold was somewhat swollen. The true cords, glottic chink, ventricular bands and associated structures were entirely normal. On admission, the temperature was 100°, pulse 100, and respiration 20.

Observation Notes: He was given hot gargles and an ice collar. On Nov. 8, at about 2 A.M., only a few hours after he had been admitted, the sense of fulness and tension in the hypopharynx, hitherto so bitterly complained of, suddenly left him. He experienced complete relief following the spontaneous rupture of the abscess. His temperature and pulse returned almost at once to normal. He felt decidedly better.

X-ray Report (Dr. S. G. Henderson; taken on Nov. 8): In the flat film of the chest, the bony thorax, cardiac silhouette and lung fields are negative. Lateral film of the neck shows swelling of the epiglottis evidently due to an inflammatory process. Anteroposterior film of the neck gives no additional information.

Direct Laryngoscopy (Dr. Gabriel Tucker): "Inspection showed an abscess in the upper surface of the right side of the epiglottis. The depth of the crater was nearly one-half inch. There was no foreign body. Secretion from the abscess cavity was aspirated and specimen collected for bacteriological study."

Smear showed Gram positive bacilli and cocci in pairs, groups and chains. No fungi nor acid fast bacilli nor spirochetes were found.

Culture showed streptococcus viridans, staphylococcus aureus nonhemolyticus and staphylococcus albus hemolyticus.

As stated before, the patient felt decidedly better almost immediately after the spontaneous rupture of the abscess. He remained in the hospital for a complete period of five days, merely for observation. He was discharged in excellent condition on Nov. 12, 1936. Several follow-ups since disclosed a normal epiglottis.

Case 2: M. S. H., female, age 27 years, was admitted to the private Otolaryngologic Service at the Pennsylvania Hospital on May 5, 1935, with the following history: She had been perfectly well until the evening of May 4, 1935. On the afternoon of that day she spent most of the time reading to her father, who was a patient in the same hospital.

In the evening of that day she complained of a slight soreness in the throat. Her mother examined the throat and, finding a red spot and nothing else to cause any concern, the patient retired that evening, taking two ¼-gr. tablets of phenobarbital. She slept very little, for the throat pain became progressively worse. She arose at 9 A.M. on May 5 (the date of admission) and her mother re-examined the throat. This examination disclosed that the tissues of the throat were unduly swollen. In addition, the patient had some difficulty in breathing and an anxious expression. She was not cyanotic. A laryngologist was called in, and advised hospitalization. The past medical history is of no significance. There is no allergic history. She had never suffered from a similar attack. General physical examination disclosed a well developed young adult lying flat in bed, with evidence of distress, dyspnea and anxiety. The head, neck, chest, abdomen and extremities were essentially normal. Examination of the pharynx revealed small tonsils, apparently not infected. Indirect laryngoscopy disclosed the rim of the epiglottis on the right side to be edematous, with a yellow pointing spot (G.M.C.) and a bulge of the right half of the postpharyngeal wall.

Observation Notes: She was given hot gargles, sedatives and ice collar. Tr. Benzoin Comp. inhalations seemed to make the patient feel better. Her temperature was 99° on admission, pulse 95, respiration 25. The next day (May 6), the temperature returned to normal and the patient felt a little better. The throat appearance was much the same as on admission. She did complain of a little pain lower down, however, especially on attempting to swallow. At noon the following day (May 7), her second day in the hospital, she commenced to have a foul taste in her mouth and, coincident with this, she felt decidedly better in every way. Re-examination later in the day showed a decided lessening of the edema of the epiglottic rim on the right side where the abscess had ruptured earlier in the day, leaving a crater of about one-half inch in depth, so that the normal larynx was more easily visualized than formerly and the postpharyngeal wall was no longer bulging. The patient did not expectorate any purulent material. She continued to improve and on May 12, 1935, after a stay of one week, she was discharged from the hospital. Re-examination seven months later disclosed a normal epiglottis, with no scar from the old abscess.

Comment: Both of these cases presented many parallel phenomena, *viz.:* the sudden onset of dysphagia, the feeling of pain, constriction and tenderness in the lower pharynx, especially on attempting to swallow, the ability to phonate, the spontaneous rupture of the abscess with immediate relief of symptoms in one and three days, respectively, the absence of any acute upper respiratory infection immediately prior to the involvement of the epiglottis, the absence of any allergic history (personal and family), the involvement of the epiglottis and no other structure, and the duration of the illness.

Michel, in 1878, termed this condition angina epiglottidea anteria, stating that the acute inflammatory process is confined to the anterior surface of the epiglottis, though the larynx may sometimes be affected to a slight extent. St. Clair Thomson[1] feels that such an infection, by strict anatomical classification, belongs to the group of laryngeal inflammations, though clinically it is more practical to consider it with other acute septic diseases of the throat. This condition may be secondary to inflammatory states of the pharynx, faucial tonsils, lingual tonsils, perhaps the posterior sinuses, or may become primarily involved by septic infection, irritating fluids or improperly masticated food, so that a small sharp particle may abrade the surface of the epiglottis, permitting entrance of micro-organisms; inhalation of pungent vapors, foreign body, *ad infinitum.*

It is to be noted that as soon as the diagnosis of abscess of the epiglottis was made, both cases were immediately hospitalized and meticulously observed. Palliative measures were instituted, and scarification was considered, but was not done. Should any urgent symptoms have arisen, they would have been adequately dealt with.

These cases can often be fatal, if improperly handled. Our greatest fear is edema of the larynx, which condition must be promptly managed. The larynx of each of these cases was entirely within normal limits, for the process remained confined to the epiglottis. This was most fortunate. It is needless to say that if any urgent dyspnea with edema of the larynx would have taken place, by the extension of the inflammatory process, tracheotomy would have been promptly instituted.

In connection with these case reports, it is not amiss to bring up once more the history of the last illness of our

revered First President of the United States, His Excellency, George Washington. Fielding O. Lewis[2] has written an excellent monograph containing an account of this illness. The history of this case briefly is as follows: Some time in the night of Friday, Dec. 13, 1799, having been exposed to rain on the preceding day, General Washington was attacked with an inflammatory affection of the upper part of the windpipe, called, in technical language, cynanche trachealis. First, he had a violent ague, with some pain in the upper and fore part of the throat, a sense of stricture in the same part, a cough and a difficult rather than painful deglutition, finally fever and laborious respiration.

He was fully impressed at the beginning of his complaint, as well as through every succeeding stage of it, that its conclusion would be fatal, submitting to the several exertions made for his recovery, rather as a duty than from any expectation of their efficacy.

Every measure in vogue, but one, at that time was used, but the General passed away at 11:30, Saturday night, Dec. 14, 1799, retaining full possession of his intellect and expiring without a struggle.

Says Fielding O. Lewis:[2] "From the history and symptoms attainable, it is my belief that the immediate cause of death was an acute edema of the larynx, secondary to a septic sore throat of a probable streptococcic variety. . . With the cardinal symptoms of laryngeal obstruction apparently present, it seems to me most unfortunate that tracheotomy, which was known at that time, was not more universally taught and practiced. Had Washington's physicians been familiar with its procedure, what a wonderful opportunity it would have been, if successful, to have immortalized a life-saving operation; it would have no doubt been the stimulus for the saving of many other lives; which today, after 200 years, is too frequently neglected."

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1721 Pine Street.

THE SINUSES AS POINTS OF FOCAL INFECTION AND THE TREATMENT OF SINUSITIS.

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INTRODUCTION AND DEFINITION.

Sinus infection is one of mankind's most common complaints; so common, in fact, that few people escape it, and many people have frequent attacks from babyhood to old age. From my own observations, I believe that sinusitis does not receive the consideration that its importance warrants.

In the past, attention has been focused almost entirely upon the extreme case of sinus infection in which the sinus is filled with pus and drainage is completely obstructed. In my experience this type of case for which surgery is the prospective treatment occurs only about once in a 100 cases of sinus infection. In the great majority of cases drainage can be established by prompt and simple care at the hands of the family doctor. It is my purpose to explain how sinus infection may be diagnosed without any other aid than the ability to take the history and discover the presence of the existing symptoms and to tell how it may be treated without the necessity of surgery.

Cases of sinusitis range in severity from mild colds in the head to chronic cases of long standing. The ones seen by the specialist are largely the more severe cases, but the family doctor sees the cases in their early stages, and it is, therefore, important that he know how to check the sinus infection.

What is now known as acute sinus infection was, until 1920, simply termed a "cold in the head." When this "cold" gave pain, it was called neuralgia. For years medical science has known of the existence of catarrh with its postnasal discharge, halitosis, hoarseness, and ozena. Catarrh is chronic sinus disease.

Not only is sinusitis of importance because it affects such a large number of people, but also because the sinuses may

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become points of focal infection, just as may a tooth or a tonsil, from which secondary infections occur at anatomically favorable points, such as the eyes, ears, throat, glands, and chest. Treating the sinus infection along with these secondary or possibly coexisting infections will do much toward curing the secondary infection.

CAUSE AND STRUCTURE.

In order to understand the causes and effects of diseases of the nasal accessory sinuses, we must remember that the sinuses are cavities surrounded by bony walls. Obstruction to drainage may easily occur because the outlets of the sinuses are very small and are surrounded by bony material. Infection within the sinus is largely the result of obstruction. Repeated attacks of rhinitis, enlarged turbinates, deflected septum, and bony growth are common causes of obstruction.

The sinus cavities become diseased by the extension of infection from the nasal cavity. When this happens, the membranes lining the sinus cavities, acting similarly to the mucous membranes in other parts of the body, enlarge. When the infection is repeated or long continued, the membrane becomes permanently damaged. Hypertrophy may form polypi.

SYMPTOMS.

Since acute sinus trouble is a cold in the head, the symptoms are the same: nasal dryness, sneezing, usually followed by profuse nasal secretion, fever, headache, stuffiness of the nose, and obstruction to breathing. When there is interference with drainage, severe pain may occur in the sinus most obstructed.

Chronic cases are characterized by postnasal discharge, frequent hoarseness, halitosis, or ozena. Mucous may be seen in the posterior nasal pharynx, and the history will reveal a condition of chronic discharge.

DIAGNOSIS.

Patients may have chronic sinus disease for many years and not consult a physician on account of the sinus. The patient consults a physician only if an acute attack occurs or if some secondary infection arises. The diagnosis is

usually made by taking a careful history of past attacks, and from the findings of symptoms of an acute attack. The presence of pharyngitis or laryngitis, an attack of cervical adenitis, middle-ear disease, tonsillitis, infected adenoids, or any acute chest infection should call for an investigation of the sinuses.

Examination of the sinuses should be made during an attack of an acute infection and again when the patient has recovered. During an attack of sinus infection we have inflammation of the mucous membrane and may have a sinus filled with fluid. This congestion may be examined by transillumination and is well shown upon the X-ray plate. When recovery has taken place, with the sinus free from fluid and the mucous membrane recovered from the infection, transillumination or X-ray pictures may not reveal evidence of the past infection. It is important to keep this in mind when examining these patients. It is not uncommon to examine patients years after they have had sinus disease and find, by transillumination and shown on the X-ray plate, the clouding of the sinus. This may simply be the scars of a disease long ago cured, and the patient may not need treatment. This fact may lead to error in diagnosis. It is necessary to determine the presence of symptoms indicating active disease at the time of examination.

Diagnosis of sinus infection can readily be accomplished from the history and a knowledge of the conditions producing the symptoms. To recognize a "cold in the head" is to make a positive diagnosis of acute sinus infection. To know what secondary infections may accompany sinus infection facilitates diagnosis of sinus disease and its coexisting infections, in the absence of any other cause. Infections of the ears, inflammation of the optic nerve, which causes the eyes to be sensitive to light; pharyngitis, laryngitis, infections of the tonsils and adenoids; enlarged glands of the neck, the neuralgias of the neck and shoulders, and infections of the chest are all possible, secondary to sinus infection, and should be carefully studied from the sinus standpoint.

SECONDARY SINUS INFECTIONS.—INTRODUCTION.

Sinus disease is an all too commonly neglected focal infection, acting just as other focal infections. Even specialists in the past seemed to consider that sinus disease involved

only the sinuses, quite dissociated from what we now know to be secondary infections. The presence of pharyngitis, laryngitis, bronchitis, diseased tonsils and adenoids, cervical adenitis, middle ear infections, and neuritis of the cervical or dorsal regions should suggest the need of examination for sinus infection.

A patient may have sinus trouble for years and not consult a physician until some secondary infection occurs. The physician often fails to look for the symptoms of sinus trouble. I cannot help but be impressed by the frequency of cases in which sinus infection existed before the onset of the disease for which the patient seeks relief. I feel that I cannot over-emphasize the idea that infections of the sinus cause secondary infections. If I am correct, the possibilities of treating all the acute infections and preventing the chronic conditions seem almost unlimited.

The position of the sinuses is most favorable to the extension of sinus infection to other parts of the body. The pus from the sinuses flows down over the nasal opening of the Eustachian tube and may thereby become a potent factor in middle-ear infection; it likewise flows over the adenoids and tonsils, and may cause them to become diseased; it also flows into the larynx and trachea, down into the bronchial tubes and lungs, becoming the possible cause of chest infections and pneumonia.

Eye: When patients are sensitive to light and require frequent changes of glasses without satisfactory results, the sinuses should be examined. A paper read by Dr. Granger, in Milwaukee, reported a large number of cases of defective vision, in which one eye was more affected than the other. and which were cured by treating the chronically infected sinus. My own observations confirm Dr. Granger's statements, and I find these cases not at all uncommon.

Ears: For many years I have examined and taken the history of every case of deafness with which I came in contact. The history indicates, with but few exceptions, that these cases of deafness have been preceded by attacks of acute sinus infection and by chronic sinus disease.

I find that earache in children is generally preceded and usually accompanied by acute sinus infection. If this infec-

tion were cared for from childhood, much of the deafness in adults might be prevented. The importance of preventing deafness is so great that I feel this subject should receive most careful attention.

Dr. Fowler, in a study of a large group of children suffering from deafness, found that 91 per cent of the children suffered from sinus infection.

Dr. Campbell, in a study of middle-ear abscesses in 150 infants, found that 91 per cent of them showed evidence of sinus infection.

Dr. M. M. Cullom[1] says that "a large percentage of the population has sinus involvement at one time or another. This means that a large proportion of the population are menaced by infection that may result in deafness, disease, and death."

Glands: We all see many children with cervical adenitis and watch them run the course of illness. Many of them have frequently recurring attacks. Often these children are anemic and underweight. In examining these children I look for the history and the evidence of infected sinuses. When diseased sinuses are present, I feel that it is as important to treat these sinuses as it is to treat the glands. The history of these cases indicates that the enlarged glands appear following the onset of an acute sinus infection.

Tonsils and Adenoids: Since about 1920, I have studied children with adenoids, and I find that in most cases the adenoid infection started with an acute attack of sinus infection. Usually after the infection is relieved in the adenoid area, the symptoms of active sinus infection are still present. Many of these cases have established chronic sinus infection with the postnasal discharge found behind the soft palate.

I have made a study of tonsils, along with the study of adenoids, and have discovered that in most cases of tonsillitis the history shows that there was first an attack of sinus infection. Many adults and mothers of children report that each attack of tonsillitis was preceded by a "head cold."

Some patients will go through the initial stage of sinus infection and have well developed adenoid and tonsil infec-

tions in a few hours. This gives us little chance to observe the train of events.

Diseased tonsils and adenoids probably exist because of the drainage of pus from the sinuses over the adenoids and faucial tonsils, or the infections may have been brought from the sinuses to the tonsils and adenoids by way of the lymphatics.

The history of tonsil and adenoid infections will show, first, a cold in the head, then the development of a secondary infection of adenoids and tonsils. These cases need treatment of the sinuses possibly more than removal of the tonsils or adenoids. I have carried out this course of action in many cases with most gratifying results.

Chest Infections: Chest infections are so common that few people escape them, and, therefore, doctors are constantly trying to find their cause, a satisfactory treatment, and a possible preventive. Several investigators have reported that chest infections are in all probability secondary to sinus infections. An exhibit prepared by Dr. M. M. Cullom, in the Scientific Section of the Philadelphia session of the American Medical Association in 1931, showed X-ray plates which demonstrated the relationship of sinusitis and infections of the chest. The exhibit confirmed the work of Mullens, Mange, Jackson, and others. Many of the patients were suffering from tuberculosis.

Dr. Cullom[1] says, "It has long been believed that sinus disease is an etiologic factor in pneumonia, from the high percentage of infected sinuses found postmortem in patients dead of pneumonia. I feel that a case has been made out against infected sinuses that is truly appalling. The infected sinus is taking up a campaign against other bodily structures which is disabling, crippling and death-dealing. It has been the fashion lately to decry the sinuses as an important focus of infection. In the light of the evidence I think it is the real factor in focal infection. I have the feeling that, owing to the position of the sinuses at the top of the upper respiratory tract, they are a menace to all lower lying structures."

For several years I have been studying the cases of chest infections, and by careful history taking, I find that a large

percentage of cases of chest infection was preceded by acute sinus infection. I have discovered that bronchitis, acute or chronic, and even pneumonia, is often preceded by acute sinus infection. In a patient subject to bronchial attacks, bronchitis may develop rapidly after the initial sinus infection. If one observes carefully, he will notice that symptoms of sinus infection precede bronchial infection, and that sinus disease is the last symptom to disappear after bronchial infection has subsided.

The lymphatics are probably the channel through which sinus infections pass from the sinuses to the tonsils and on to the bronchial tubes and lungs. Lung abscesses following tonsillectomy indicate that the lymphatics of the tonsils and lungs are closely related. Can you visualize the great opportunity to help these victims if we recognize the infected sinuses and treat them? I have been following this course of action for several years with surprising results.

Since patients seldom complain of sinus infection, doctors have treated only the chest and left the focal infection untreated. I find that when I treat both sinus and chest, the results are more gratifying than when I treat the chest alone. When the sinus and chest are treated, the patients have fewer and less severe attacks of chest infections than before the sinuses were treated. I noted this especially in the patients who have had repeated attacks of chronic bronchitis.

Neuritis: In many cases of neuritis, especially cervical neuritis, in which the neck, arms, and dorsal nerves are affected, sinus infection commonly precedes the neuritis. Whenever sinus disease is found it should be treated. The neuritis will then usually be improved.

In cases of chronic neuritis, a physician should always look for sinus infection, and when other causes have been eliminated, the sinus infection should be treated.

Dr. Cullom[1] says: "While the connection between retrobulbar neuritis is not on such a sound basis, the work of Leon White and others, as shown by Gordon Hoople, cannot be ignored. The weight of evidence is against the sinuses here, and further investigation will no doubt confirm their guilt."

CONCLUSION.

When we approach cases of sensitive eyes, infected adenoids and tonsils, middle-ear infections, cervical adenitis, neuritis, pharyngitis, laryngitis, and chest infections with the idea that their origin was in the sinus cavities and keep watching to see when the sinus infection disappears, we view these infections in a new light, and we see new possibilities for their treatment and prevention. My observations are purely clinical, but it is my sincere hope that other doctors will observe the symptoms of the above infections carefully and will check their observations with mine. I am convinced that herein lies an unusual opportunity to do something worth while for patients suffering from sinusitis.

TREATMENT OF PARANASAL SINUSES.

The treatment for sinus infection is so simple that every family doctor can handle it well. He must be familiar with the anatomy of the nose and the sinuses, and he must have and be familiar with the instruments used to see the nasal cavity. He must know that the sinuses drain into the nasal cavity; the frontal and anterior ethmoid drain near the anterior end of the middle turbinate bone; the sphenoid and postethmoid drains above the posterior end of the middle turbinate bone. The maxillary sinus opens near the mid-portion of the middle turbinate bone; the Eustachian tube opens posterior to the inferior turbinate.

The family doctor must remember that medicine put into the nose is for the purpose of relieving congestion in an effort to establish drainage or increase it. To aid drainage it is necessary to put medicine into the nasal cavity in such a way that it will come in contact with the tissues over or near the openings of the sinuses. These applications must not increase the congestion nor be irritating. For this purpose I used as a routine a 5 per cent to 10 per cent solution of argyrol in equal parts of water and glycerine. This is introduced into the nose by saturating cotton on a wooden applicator that has been boiled in paraffin. The paraffin is used to make the applicator so smooth that it can be withdrawn and leave the cotton in the nose. If the cotton is pressed flat it will aid in covering more of the nasal surface. Often I apply one of the cotton pledgets high in the

nose and one under the inferior turbinate. These cotton carriers of medicine must be placed the entire length of the turbinate, so as to get the medicine to the posterior end of the nasal canal where there is the greatest need of reducing the swollen membrane. The cotton carrying the medicine is left in place about 20 to 30 minutes; usually I leave it until the drainage has been free for a time and then has almost ceased. Suction may be used, but I seldom find it necessary to start the drainage.

Any one of several medicinal substances may be used in the nasal cavity, but the family doctor must select a medicine that will be of value in reducing congestion and still not irritate the mucous membrane. Preparations of camphor, menthol, and ephedrine or other mild alkaline solutions are used satisfactorily in the nose insofar as they give relief to the patient.

There are two difficulties to be considered in regard to this method. The first is the difficulty of getting medicine inside the sinuses: When the opening of the sinuses is much obstructed, this method is almost sure to result in failure and it is sometimes distressing to the patient; the other difficulty lies in the fact that any medicine strong enough to destroy the infective germs will also injure the nasal mucosa.

By using local anesthesia we may enter the maxillary sinus with instruments and wash it out with an antiseptic. This practice seems logical, but I find most patients will not permit me to do this as a routine treatment. They prefer the sinus infection to the treatment.

Steam, together with the vapor of such substances as camphor and menthol, may be inhaled. The fact that the patient feels more comfortable is the chief value of this method. Hot wet applications over the face or a hot water bottle or electric pad placed over the infected sinus give comfort.

From my experience I find the infra-red lamp to be the most effective method of applying heat to the sinuses. There is reason to believe that the infra-red rays penetrate the sinus and influence the circulation therein, thus aiding more than any other safe, simple treatment at our command. For treating infants and small children this is almost the only available and the most valuable treatment that I know.

The infrared lamp should be used as hot as the patient will permit. The time of treatment is usually 20 to 30 minutes. In severe cases the treatment should be repeated about once in 12 hours or about once each day. Severe cases in the home should be treated about once every six hours.

The Kromayer lamp is very helpful in relieving the congestion of the nasal mucosa and in aiding drainage. I believe it has little or no value within the sinus itself.

Serum is practical and will help in many cases. Its place seems to be limited to the cases of recurrent attacks in which the resistance to infection has been lowered. If the serum increases the resistance, it is beneficial; but if it does not, the patient is better off without it.

This treatment applies to all but the rare case in which the sinus is filled with pus and drainage cannot be established. Such a case must have special care, which is usually given by the otolaryngologist.

In 15 years I have found but five of these rare cases which required surgical care. I have also observed six cases of chronic disease with unusual pathology in the sinuses. They consisted of two cases of cancer, two cases with meningitis, and two cases where the sinuses were filled with polypoid tissue. With the exception of these 11 cases, I have never found a case that would not respond favorably to the treatment outlined above. The small number of cases which need the care of a specialist should indicate the importance of the family doctor's ability to properly care for those who suffer from sinus infection.

For some time X-ray has been used in the treatment of sinus infection. The X-ray is one remedy that will penetrate the sinus cavity and have power to affect the tissues within. After two years of treating and studying, I am convinced that the X-ray offers the most of any one method available; however, it must be used with caution. Since the sinuses are constructed as tney are, there is danger of causing obstruction to drainage. X-ray cannot be used unless drainage is properly cared for, and should be used mostly in chronic cases. To avoid this obstruction I give a small initial dose of X-ray, follow the treatment by packing the nose with argyrol and glycerine, and then use the infra-red rays.

In acute attacks the X-ray must be used carefully in order to avoid obstruction.

Before administering the X-ray treatment, I cover the untreated areas with lead rubber, leaving exposed the sinuses to be treated. The eyes are covered with lead. The first treatment is from 30 to 50 R. The usual amount is from 50 to 100 R., up to 150 R.

Treatments are given three to five days apart, depending upon the patient's reaction. The number of treatments given average from five to eight; no definite number is necessary. Chronic cases need the most treatment.

More time and more experiments will be necessary before the true valuation can be placed on X-ray treatment of sinus disease. Not all patients are cured by the X-ray treatment. We must not forget that the patient will still have the sinus, and reinfection may occur. My experience, however, has been that most patients treated have improved quickly, and thereafter have had fewer and less serious attacks.

CONCLUSIONS.

Acute sinus infection is simply a "cold in the head;" chronic sinus disease is catarrh. The sinuses are cavities surrounded by bony walls with small outlets also surrounded by bone.

Infection is the usual cause of disease. Obstruction to drainage prevents the natural recovery from the infection. Repeated attacks of sinus infection result in the chronically infected sinus. The symptoms of acute sinus infection are those of a cold in the head. Chronic sinus disease is characterized by postnasal discharge, frequent hoarseness, halitosis, and ozena. The history reveals conditions of chronic discharge.

Sinus infection is diagnosed from the history and the clinical findings. Transillumination and X-ray are most helpful if used when the cavities are full of pus, polypoid growths, or scar tissue. Examinations should be made during an acute attack and again during a period of quiescence.

Clinical evidence tends to prove that sinus infection is a focal infection from which secondary infections of the eye, ear, glands of the neck, tonsils, adenoids, chest, and nerves

may occur. Treating the sinuses when these secondary infections occur has in most cases greatly aided recovery. This lead opens a whole new field of prevention and treatment for these diseases. Help is greatly needed for this class of cases.

Getting medicine into the sinuses is difficult and often ineffective. Packing the nose with argyrol and glycerine increases drainage. Surgery should be resorted to only when drainage cannot be re-established.

The infra-red ray treatment is the most satisfactory for children, and it tends to prevent later attacks of ear, eye, tonsil, adenoid, and chest infections.

The use of X-ray is the most satisfactory treatment for sinus infection. This treatment, however, must be used carefully in order to prevent obstruction, especially in acute cases. While X-ray may not entirely cure sinus disease, it tends to decrease the frequency and the severity of the attacks.

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OSTEOMA OF THE SINUSES.*†

DR. MATTHEW S. ERSNER and
DR. MAURICE SALTZMAN, Philadelphia.

A small osteoma of the sinus is of rather frequent occurrence. In the routine X-ray examination of the sinuses it is frequently found in patients who are symptomless. One often wonders whether this condition should be called an osteoma, signifying a tumor, or whether it should be called an exostosis, designating a tissue reaction with the deposition of calcium salts. The pathologist does not contribute greatly toward settling this problem. McFarland[1] speaks of it as ivory-like exostosis of cranial bones formed by osteoblasts which are concentrated in great numbers in the periosteum and endosteum. McCallum[2] explains that ossification of tissue may take place if degenerative changes and deposition of calcium salts have occurred. The presence of Haversian canals is not a distinctive feature and often these tumors are capsulated from the tissues of origin. Garretson[3] classifies them into three varieties: *1.* the hard eburnated, *2.* the compact and *3.* the spongy. Histologically, there is an eburnated outer coating which surrounds a more or less cancellous centre. The Haversian canals and lacunae when present are irregular both in form and arrangement. Beck[4] calls the spongy form osteoidema. The osteoid element consists of irregular islands of variable size which are made of poorly formed concentric rings with no nuclear or cellular structures.

An osteoma becomes a surgical problem when it enlarges and encroaches upon surrounding structures, or when it obstructs drainage from a sinus. On studying Carmody's[5] tabulations of the reported osteomas in the literature, we find that it occurred ten times more often in the frontal sinus than in either the ethmoid or maxillary. Multiple involvement is a rarity. There are only a half-dozen such cases in

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the English literature. There are two reports of osteomas involving all sinuses in the German literature,[6] but no details are given and they appear to be principally frontal osteomas. Of those that were treated surgically and proved at operation, Garretson's[3] case involved the frontal, ethmoid and orbit, while Culbert's[7] case occupied the frontals, right ethmoid, right orbit, extending into the crista galli and protruding into the cranial cavity. From the point of view of the multiplicity of involvement and extensiveness of operation, our case is the third to be reported in the literature.

M. S., age 19 years, came to us on Aug. 31, 1936, with the complaint of obstruction to breathing in her left nostril and of pain in her left eye. She stated that she had been perfectly well until the winter of 1935, when she developed an "acute cold." Following this, she experienced difficulty in breathing through her nose, which became progressively worse. Pain was first complained of in May, 1936, and this was referred to the left side of her face and under her left eye.

She had diphtheria at age 3 years, measles at 5, chickenpox at 10 and mumps at 14. Otherwise, her health was very good. Her family history was irrelevant.

On physical examination, the patient appeared well nourished and of good color. Her heart, lungs and abdomen were negative. Her tonsils were hypertrophied. The lacrymal sac on the left side was distended and some lacrimation was noted. The left eye was displaced laterally and there was narrowing of the palpebral fissure. The submaxillary lymph glands on the left side were somewhat enlarged. Rhinoscopically, the left nostril was filled with a grayish mass that had the appearance of polyp. However, stony hardness was elicited when touching it with a probe, nor did it respond to shrinkage.

Transillumination: Frontals, cloudy; antra, right clear, left cloudy; ethmoids, right slightly cloudy, left cloudy.

The patient's temperature was 98.2°, pulse 76 and respiratory rate 20. Her blood count: Hb. 88 per cent, R.B.C. 4,510,000, W.B.C. 11,200, polys. 57 per cent, S.M. 43 per cent. Urinalysis (non-catheterized specimen): a faint trace of albumin, 20-30 W.B.C., 1–2 R.B.C., and an occasional hyaline and granular cast. Blood Wassermann and Kahn negative,

sugar 98, phosphorus 3.6, calcium 8.5 on Aug. 10, 1936, and 8.8 on Aug. 11, 1936.

The X-ray report is as follows: "There is an enormous bony density involving the entire left nasal space and extending up into the frontal sinuses. There is some extension both laterally into the antrum and mesially toward the right nasal cavity. The general appearance is that of a benign osteochondroma. The inferior and mesial margin of the left orbit also is encroached upon by this tumor. The sphenoid sinuses are not involved."

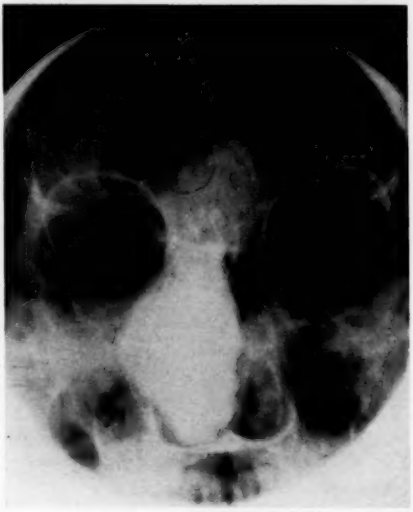

Fig. 1. X-ray before operation.

It is evident that the X-ray interpretation would determine the surgical approach. Had we agreed with the radiologist that the osteoma had invaded the cavity of the left antrum, then the Caldwell-Luc operation would have been indicated, dealing with the ethmoid region transantrally would have been an easy route and the cosmetic results might have been better. We felt, however, that the pathologic process was not invading and it would not go through anatomic walls; that it probably had a single point of origin at its densest point, around which deposits of calcium salts had

accumulated and ossification proceeded; that this process was space-taking by pressure, pushing over the nasoantral wall to one side and the septum to the other. The eyeball was outwardly and somewhat downwardly displaced, which constituted a good clinical sign of ethmoid and frontal involvement. The external ethmoid and external frontal operations were clearly indicated. We felt that following the tumor from above downward would tend to insure completeness and save time. The operation was done on Aug. 7, 1936, under Avertin anesthesia supplemented by ether. A bilateral frontal incision was made. The external plates of both frontals were

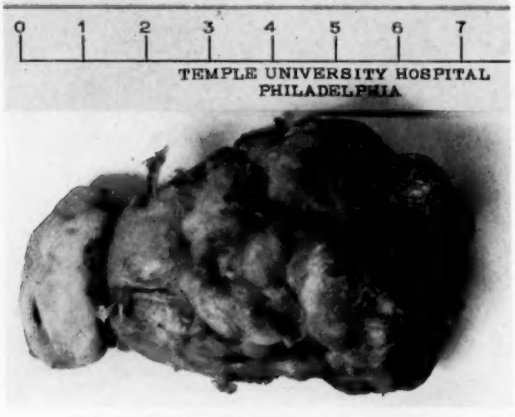

Fig. 2. Gross appearance of the osteoma.

removed. An osteoma was found in the right frontal sinus, while the left one contained inspissated mucus and a polyp-like mass. A culture was taken under sterile precautions. Following the extending tumor an external ethmoid incision was made. A cast-like tumor of stony hardness was found to have replaced the ethmoid labyrinth and extending posteriorly into the sphenoid. Upon following the mass down it was found necessary to remove the nasal bone. The nasal cavity was filled with this mass pushing the nasoantral wall about one inch laterally and causing pressure atrophy of all the intranasal structures and almost completely obliterating the antrum. The middle turbinate had the appearance of a

thin ribbon. The osteoma was removed by the use of mallet and gouge and the electric drill.

The specimens were extremely hard eburnated bone, two pieces, weighing 70 gm., the largest measuring 6 x 4 x 2.5 cm. The pathologist's diagnosis was osteoma. The cultures from the nasofrontal duct and frontal sinuses showed hemolytic staphylococcus albus.

The wound healed by primary union and the recovery was uneventful. There was a moderate postoperative reaction with a febrile state lasting three days. Diplopia due to detach-

Fig. 3. After operation.

ment of the pulley of the superior oblique was present soon after the operation. It gradually diminished and disappeared entirely five weeks after the operation. In spite of the extensiveness of the operation, the cosmetic result was a fairly good one and though the bony support from the lacrimal sac and duct was largely removed, the function returned to a normal state. The same is true of the ocular muscles and our results being better than we hoped for.

The radiologist's report on Aug. 24, 1936, is as follows: "Comparison with preoperative study made July 31, 1936, shows complete removal of the osteoma then described."

The patient was seen again in April, 1937, eight months after the operation. The empty space intranasally is filling

in. There are no crusts. The turbinates have regenerated partially and the mucous membranes appear healthy. A recent X-ray study reveals no trace of the osteoma and there is no evidence of the possibility of recurrence.

COMMENT.

Almost every author who has reported a case of osteoma of the sinuses discussed the etiology of this condition. Before

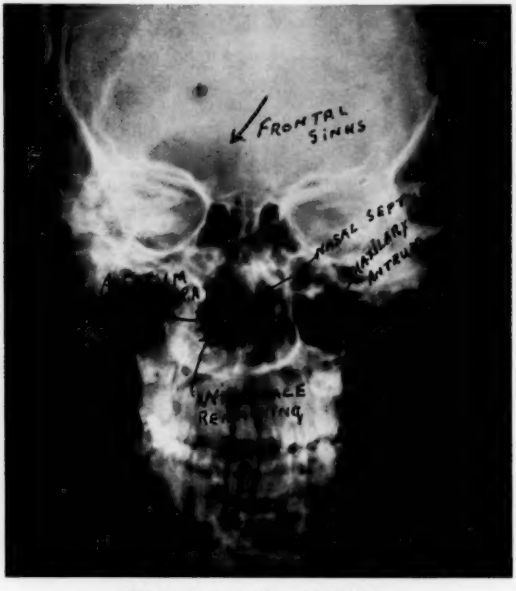

Fig. 4. X-ray after operation.

the days of serology, syphilis was considered as the cause. The Wassermann test has largely disproved this theory. Trauma was found to be a factor. This was true in one of Carmody's[5] cases. Surgical pathologists attributed the condition to aberrant embryonic cartilaginous cells. This was largely theoretical, as no one ever demonstrated the existence of such cells. The cancellous structure of the diploe where the periosteum is loosely attached and where cellular activity is enormous was considered by Virchow[6] as the origin of

osteoma of the frontal bone. Gerber[9] was the first author to consider sinusitis as the antecedent of this condition. This opinion was concurred in by Cloquet,[10] who spoke of the ossification of mucous polyps. Reading over the histories of osteoma in the literature, one is impressed with the frequency of "lagrippe" or "head cold" as the beginning of the trouble. In our own case, the patient dates back her trouble to an attack of acute sinusitis, after which her nasal obstruction became gradually worse and she began experiencing pain in the left side of her face and left eye. Considering, how-

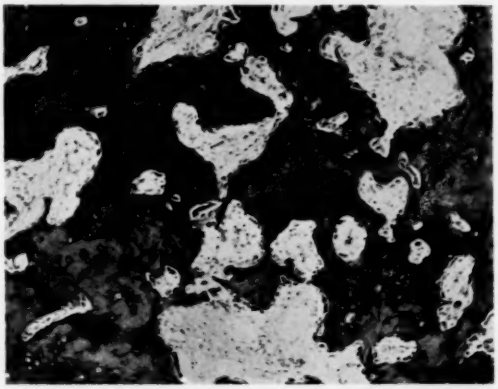

Fig. 5. The specimen histologically appears (Low Power) to approximate compact bone in some regions and cancellous bone in other areas. A few ill-defined Haversian systems are seen, but the lamellae are chiefly of the interstitial variety. Lacunae with their constituent bone cells are plentiful. The marrow cavities appear relatively inactive. Ossification is incomplete in many regions.

ever, that while so many millions of people suffer annually of sinusitis and osseous growths develop in so small a percentage, one must fall back to the theory of tissue susceptibility. Be it an anomaly of the growth of embryonic genesis or the result of a metabolic imbalance, the fault lies in the cells themselves, whether in the bone or in the periosteum. One man's frontal bone will grow an osteoma while another man's will not. Trauma or inflammation may excite a quiescent inherent tendency. As in other forms of neoplasm, these factors may be spoken of as exciting causes, the chief of which is undoubtedly infection of the sinuses.

In the study of our case, one fact was preeminent; namely, that a pure strain of staphylococcus hemolyticus albus was isolated from the culture. In bone pathology such a fact cannot go unnoticed. We all know that this is the organism that causes osteomyelitis in over 90 per cent of the cases. Mosher[11] has focused our attention on osteomyelitis of the frontal bone. In his histologic description he speaks of the "new bone on the surface of the specimen." Thus, the organism that causes the most serious destruction also causes new bone formation at the same time, stimulating osteoblasts as

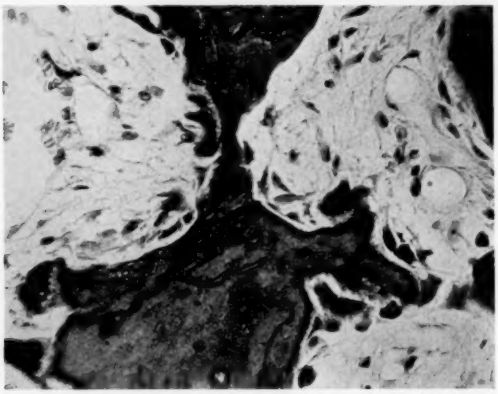

Fig. 6. Many lamellae are incompletely formed (High Power). The marrow spaces are relatively acellular, consisting of connective tissue cells, fat cells and blood vessels. No hematopoietic elements are seen. Osteoclasts are present. Lacunae containing bone cells are more evident.

well as osteoclasts. One wonders, then, if there is not a strain of these organisms that are less virulent and reverse the pathologic process by a greater stimulation of the builders than the destroyers. In a search of the literature we find a line of thought that serves well our thesis. Green and Shannon,[12] in an extensive study of osteomyelitis in children, found that in the less virulent forms of the disease no destruction occurred, that "the loosely attached periosteum ruptures, allowing the pus to escape without formation of a sequestrum." This is just what is likely to happen in the frontal sinus, especially in the young. Should a low-grade infecting organism invade the frontal sinus and cause an exudative process, the organism at the same time having the opsonic

selectivity for the stimulation of the osteoblasts, a soft mass with an affinity for the deposition of calcium salts will form and an osseous growth result. This is sound pathologic doctrine. A low-grade staphylococcus hemolyticus would be the logical organism and the frontal sinus, the suitable soil. This should be a fertile field for experimental research. Our contribution of the analysis of one case, while it cannot prove a pathologic theorem, may provide a new concept of this problem.

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LOW-GRADE FEVER, THE RESULT OF NASOPHARYNGEAL INFECTION.*

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Patients suffering from long-continued, low-grade fever and fatigue often present a problem baffling for the diagnostician. Such cases of obscure fever are not rare. Kintner and Rowntree[1] reported 100 cases of long-continued fever, which were studied at the Mayo Clinic from June, 1919, to June, 1930. Extensive physical and laboratory studies of the patients failed to reveal the origin of the ailment, which was characterized by the following symptoms: variation in mouth temperature from 99° F. to 103° F., exhaustion, nervousness and loss of weight, accompanied in some cases by abdominal distress, pain in the back, headache, cough, palpitation, or generalized body pains. The onset of the fever was insidious in the majority of cases.

Obscure fevers have been the subject of discussion repeatedly in medical literature.[2,3,4] A symposium on fevers of unknown origin, held at the April, 1935, meeting of the Illinois State Medical Society,[5,6,7,8] brought forth additional evidence of the extent of this diagnostic problem, with a similar description of the symptoms associated with the syndrome. According to Carr,[5] "the symptoms of the mild or subfebrile type (of fever) are not marked. Often these are related to an ordinary cold or sore throat, perhaps a bronchitis, subsequent to which the patient improves from the more acute symptoms, yet fails to regain former good health. A moderate or slight cough may persist. A prominent symptom is a lack of the patient's usual vigor; there is a disinclination to exertion, mental or physical; the patient tires easily and complains of a constant sense of fatigue. The appetite may be impaired. Vague muscular pains are often present. A moderate leukocytosis, 10,000 to 15,000, may be present, although the leukocyte count is not infrequently within normal range."

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THE NASOPHARYNX AS A FOCUS OF INFECTION.

Fifty-nine cases which came under my observation during the past three years presented symptoms strikingly similar to those described. Most of these patients were referred by physicians as having fever and fatigue, which had run a prolonged course without at any time presenting features, symptomatic, clinical, or laboratory, which warranted a definite diagnosis. Three of these patients were relieved of the symptoms following the removal of abscessed tonsils; one recovered from the low-grade fever after a mastoidectomy was performed, and the remaining 55 were found to have nasopharyngeal infections. It is the purpose of this paper to present these cases as evidence that generalized symptoms of bacterial toxin absorption, particularly low-grade fever and fatigue, may result from chronic infections of the nasopharynx and that treatment of this area, with subsequent disappearance of the inflammation, will result in complete relief of symptoms in a large percentage of cases.

In cases of unexplained fever, a search is usually made for a focus of infection. Although sinuses,[9] teeth, tonsils and pharynx are examined carefully as possible foci, the nasopharynx seems frequently to be overlooked. In my experience, the oropharynx and nose may appear normal when a direct examination of the nasopharynx reveals definite inflammation. This area provides a very favorable site for the growth of bacteria, with its comparatively constant temperature and suitable reaction of secretions. It is richly supplied with blood, facilitating the absorption of toxins into the circulation. A rather high grade infection may be present, even though the patient does not direct attention to the area, inasmuch as drainage is maintained and no particular discomfort is experienced locally.

Kully[10] has called attention to the nasopharynx as a focus of infection in his report of 88 cases of cysts and retention abscesses of the area. The symptoms attributed to these findings are postnasal discharge, headache and persistent fever.

Two British publications of earlier dates also stressed the importance of a careful direct examination of the nasopharynx in cases of chronic toxemia or systemic infections. In 1921, LaPage[11] reported that chronic infection of the naso-

pharynx serves as one of the most important foci which cause a lowered state of health in children, particularly referring to heart trouble. Gordon,[12] in 1931, published an article referring to the nasopharynx as a focus of infection, frequently secondary to sinus infection.

While the conception of the nasopharynx as a focus of infection is not new, it seems to have received very little consideration in this country. So far as I know, nothing has been published in regard to direct treatment of the area. I feel, therefore, that this study may be of interest to any physician who encounters cases of low-grade fever which fall into the category of fevers of unknown origin as mentioned above.

REPORT OF CASES.

Case 1: A woman, age 23 years, a university student, was in excellent health until November, 1935. At that time, without any determinable precipitating factor, she gradually became aware of increasing fatigue and weakness. She had been carrying a heavy schedule and doing secretarial work two or three hours a day without any difficulty until the onset of this illness. She finally consulted a physician, who discovered an afternoon elevation of temperature. X-rays of the chest were taken in January and there was discussion as to the presence of a "soft spot" in her lungs. She was ordered to bed, but continued to feel weak and the afternoon elevation of temperature continued. There was no pain in the chest, no cough, no sputum and no night sweats.

In June, 1936, after six months of rest at home, the patient was sent to the Edward Sanitorium under suspicion of having pulmonary tuberculosis. X-rays taken there were reported as negative for tuberculosis. She remained in the sanatorium for five weeks, during which time she developed anorexia, nausea and vomiting, in addition to her other symptoms. Up to this time she had lost 10 pounds in weight.

On July 12, 1936, four days after she was discharged from the sanatorium, she was admitted to Wesley Memorial Hospital (Hospital No. 174982), where physical examination, X-ray of the chest and sputum examinations failed to reveal any evidence of pulmonary tuberculosis. The blood count was: Erythrocytes, 4,100,000; hemoglobin 13.2 gm., 78 per cent (Newcomer method); leukocytes, 4,850, of which 55 per cent were polymorphonuclear neutrophils, 1 per cent eosinophils, 1 per cent basophils and 43 per cent lymphocytes. The urinalysis was normal. The Wassermann and Kahn tests were negative. An examination of the feces showed nothing abnormal; no tubercle bacilli were found in smears prepared from antiformin sediment as well as from fresh material. Her temperature while she was in the hospital ranged from 98° to 100.2°, reaching its peak at 4 P.M. each day. An examination of the nose and throat region showed an irregular septum, not obstructive; the sinus area was well visualized and no discharge was evident; the vault of the nasopharynx was definitely edematous, the pharynx was normal; the tonsils were cleanly removed, the lingual area and larynx were normal and the ears were normal. A culture of the nasopharynx showed a slight growth of streptococcus viridans and neisseria catarrhalis.

Treatment of the nasopharyngeal vault was started and an ice collar was applied to the throat for one-half hour three times a day. The

patient's condition improved and she was discharged after nine days in the hospital, but continued treatments. Four weeks later, during which time she had six treatments, she was free from fever and fatigue and was able to resume work. The culture at this time showed a moderate growth of hemophilus hemolyticus and an occasional colony of streptococcus viridans and neisseria catarrhalis. She continued to be entirely free from symptoms for three months. During the latter part of November she had an acute cold, followed by recurrence of fatigue and fever, which subsided after five treatments. She remained afebrile and without symptoms, although carrying a full schedule of work, until Feb. 5, 1937, at which time the fatigue recurred, accompanied by a temperature which reached 99.2° daily. Following intensive treatment for 10 days, the patient again recovered from her symptoms. On March 16, she was given a thorough examination and found to be in excellent physical condition. The weight lost during her illness had been regained.

This patient had symptoms simulating pulmonary tuberculosis. Bed rest over a period of seven months did not alleviate the symptoms. Local treatment of an inflamed nasopharynx was followed by complete recovery. While the bacterial findings in this case were slight, the inflammation was definite during each attack and the repeated disappearance of symptoms following treatment of the area leads to the conclusion that her illness was due to absorption of toxin from the nasopharynx.

Case 2: A young woman, age 20 years, was admitted to Wesley Memorial Hospital (Hosp. No. 166827) on Feb. 20, 1934, for diagnosis because of an afternoon temperature ranging from 98.8° to 99.4° of two weeks' duration, pain in the epigastrium and right lumbar region, and a sensation of weakness and nervous instability.

She had had an appendectomy and a tonsillectomy in childhood. Two years prior to this illness she contracted dysentery, which was epidemic in the school she attended in Paris, France. She was ill for six weeks. Since that time she has had neither diarrhea nor blood in the stools. The family history revealed no cancer, tuberculosis, diabetes, or Bright's disease.

A thorough physical examination was made by an internist, but nothing was found to suggest the etiology of the fever. The chest was clear.

Although the patient had had a white blood count of 17,500 at the onset of illness, her blood count at the time she was in the hospital was normal. The urinalysis was negative. The basal metabolic rate was +6 per cent. X-rays of the chest revealed no evidence of tuberculosis. A fractional gastric analysis gave results within normal limits. The blood culture produced no growth. An electrocardiogram showed no significant conduction deformities. Culture from the pharynx produced a heavy growth of a mixture of organisms with a marked predominance of streptococcus hemolyticus. After she was discharged from the hospital an autogenous vaccine was administered for two months. No local treatment of the throat was given. She continued to have fever until May, 1934, when she went to Wyoming for the summer. During her stay there she was free from symptoms. On her return to this locality in the fall she suffered an almost immediate return of fatigue and afternoon fever, which persisted through most of the winter season. Early the following spring she spent several months in California, again with normal temperature and no complaints. Through the fall and winter of 1935 and 1936 the elevation of temperature was almost constant. Some days she felt well and other days extremely weak.

In April, 1936, the patient was referred to me because of low-grade fever and marked fatigue of two years' duration, pain in the shoulder, anterior and posterior cervical glands. Examination of the nose revealed an irregular septum, not obstructive. There was no evidence of sinus

infection. The vault and the lateral wall of the nasopharynx revealed marked congestion, with an excessive amount of mucus discharge. The lateral wall of the pharynx showed slight hypertrophy. Tonsils were well removed. The larynx and ears were normal. The cervical glands on the right were enlarged but not tender. A culture of the nasopharynx produced a moderate growth, with a marked predominance of streptococcus viridans. The patient was treated by direct application of astringents and gentian violet solution. After four treatments the temperature remained normal and fatigue gradually subsided. Eight treatments were given over a period of seven weeks.

It is impossible to draw any conclusion concerning this case, inasmuch as the patient left this city and has made no response to a questionnaire.

Case 3: A graduate nurse, age 26 years, was examined by an internist in July, 1935. Her complaints were a loss of four pounds in weight, fatigue, chest pain, and a low-grade temperature. Physical examination, aside from the throat, was entirely negative except for an elevated temperature, 99.4°. The white blood count was 6,800, red blood cells, 4,500,000, and hemoglobin, 13.2 gm., 78 per cent. The urinalysis was negative. X-ray of the lungs revealed normal findings except for an old lesion, well healed.

The patient was referred to me immediately. The nose and sinuses were normal. The tonsils had been well removed. The nasopharynx showed a diffuse subacute infection, which was present to a lesser degree in the pharynx. A culture of the nasopharynx produced a heavy growth of streptococcus viridans. She was given four local treatments and directed to use irrigations. The symptoms were entirely relieved and the patient's weight returned to normal. A culture taken after the series of treatments produced a slight growth of staphylococcus albus.

One year later, June 25, 1936, the patient returned complaining of a loss of weight of five pounds in three weeks and a return of fatigue, cough and fever. A culture of the nasopharynx produced a heavy growth of pneumococcus type IV and numerous colonies of streptococcus viridans. Three treatments were sufficient to clear up the inflammation and the patient reported that she was feeling very well.

On Oct. 2, 1936, she suffered another recurrence with a loss of three and one-half pounds in weight. The bacterial flora of the nasopharynx at this time was pneumococcus type IV and streptococcus viridans. Four local treatments were given. The patient was discharged on Oct. 22, 1936, feeling well and gaining weight. She has had no further symptoms up to this time.

This patient is susceptible to nasopharyngitis, with sufficient absorption of toxin to cause a noticeable weight loss in addition to debility. Fortunately, she responds to treatment quickly, and is able to keep up her normal activity because she is co-operative and presents herself for treatments as soon as an attack occurs.

Case 4: A boy, age 6 years, was taken to a pediatrician on Jan. 18, 1936, because he had an afternoon temperature, was tired and did not look well. Examination revealed a slight pharyngitis, a mitral murmur which was soft and not transmitted, a pulse rate of 110, and a temperature of 99.2°. Because of the possibility of a subacute bacterial endocarditis, he was examined for several subsequent Saturdays. The pulse rate on each examination was around 100, the temperature 99° to 99.4° at 2:30 P.M. A tuberculin test made on Feb. 8, 1936, was negative. By that time the pediatrician felt convinced that there was no valvular involvement. At each visit he found that the pharynx showed a persistent redness, with enlargement of follicles on the posterior wall. The patient was referred to me on Feb. 8, 1936.

Examination revealed normal structures of the nose, no evidence of sinus infection, tonsils cleanly removed, the nasopharynx and pharynx definitely inflamed. A culture of the nasopharynx produced a heavy growth of streptococcus hemolyticus, streptococcus viridans and neisseria catarrhalis. The area was treated six times at weekly intervals.

On March 21, 1936, the patient was asked to return to the pediatrician for examination. He was found to be in good health. He had been free from fever for 10 days. The heart involvement was definitely ruled out.

Since that time the boy has had three acute colds, each one followed by a low-grade fever, which subsided after a few treatments. The nasopharynx culture at the time of each cold showed neisseria catarrhalis and streptococcus viridans. There has been no recurrence of the streptococcus hemolyticus infection.

It seems possible that this boy might have suffered permanent heart damage had his focus of infection not been discovered. At any rate, a heavy growth of streptococcus hemolyticus in the nasopharynx is not a normal finding, but one from which serious complications are liable to result.

Case 5: A boy, age 10 years, was taken to a pediatrician on June 8, 1935, because he was known to have had a fever ranging from 100° to 100.6° for two weeks. A thorough physical examination revealed no abnormalities except inflammation of the pharynx. A tuberculin test was positive. However, X-rays of the chest revealed no evidence of active tuberculosis. He was kept in bed at home under observation for one week. The elevation of temperature continued.

On June 15, 1935, he was referred to me for nose and throat examination. The nose and sinuses were entirely normal. The oropharynx and nasopharynx were markedly reddened. A culture produced a heavy growth of streptococcus hemolyticus. The area was treated 10 times with suitable astringents and gentian violet solution. After this series of treatments the throat appeared normal and the patient was free from fever and felt well. He had three recurrences, starting with acute colds, at approximately six-month intervals. The first was a reinfection with streptococcus hemolyticus; the second and third were both pneumococcus type III infections. On each occasion, after the initial attack, the patient was treated only once or twice.

In this case the recurrence of symptoms twice with the same species of organism, particularly with pneumococcus type III, leads one to suspect that the focus was not entirely eradicated at the time of the first attack, but was reduced to such an extent that body defenses were able to cope with the infection and symptoms subsided. The organisms were probably harbored in a relatively quiescent state until body resistance was lowered by an acute cold. There is always a tendency for patients to discontinue treatments and medication as soon as the symptoms subside.

Case 6: A girl, age 13 years, was admitted to Wesley Memorial Hospital (Hospital No. 153728) on Nov. 17, 1930, because of attacks of sore throat and fever each fall for the past three years. Painful joints were associated with these attacks so that the child was unable to attend school. Physical examination was completely negative except for enlarged lymphoid masses on the posterior wall of the pharynx and bilateral cervical adenopathy. The patient's metabolic rate was +3 per cent. The urinalysis was normal. Culture from the pharynx produced a heavy growth of a variety of organisms, including many colonies of nonhemolytic streptococci. X-rays of the sinuses were normal. She was discharged with no diagnosis.

From 1930 until 1934, the patient was unable to attend school regularly because of long periods of fatigue and low-grade fever each winter.

On April 29, 1934, she was again admitted to the hospital (Hospital No. 167465). Three weeks prior to this admission she felt dizzy while at school and developed a headache. The school nurse discovered that she had a temperature of 100° and sent her home. Headache and dizziness persisted. A complete history revealed no significant findings except the following: frequent sore throat, hoarseness in the morning, sharp stabbing pain substernally when she coughed and frequent attacks of fever and fatigue.

The only variations from normal in the physical findings were a slightly injected pharynx and a slight cardiac murmur in the mitral area. A number of laboratory tests were made; a blood culture produced no growth. The pharynx culture showed a mixture of organisms with no one type predominating. The nasopharynx culture showed a very marked predominance of streptococcus viridans and occasional colonies of neisseria catarrhalis. The urine was amber, cloudy, having a specific gravity of 1.010, an acid reaction, negative sugar, a faint trace of albumin, no casts, no red blood cells, one to two white blood cells per high power field. The red blood cells numbered 4,830,000; the white cells 10,900, of which 72 per cent were polymorphonuclear neutrophils, 1 per cent eosinophils, 26 per cent lymphocytes and 1 per cent large mononuclear cells. The hemoglobin was 15.3 gm., 90 per cent (Newcomer method). X-rays of the chest showed no evidence of pulmonary tuberculosis. The patient was discharged, with a diagnosis of streptococcic sore throat.

She was first examined by me in May, 1934, after being discharged from the hospital. At that time the examination of the nose and sinuses revealed negative findings. X-rays of the sinuses showed no evidence of involvement. The nasopharynx revealed many prominent lymph follicles, with an excessive mucus secretion. The lateral wall of the pharynx was moderately hypertrophic. The tonsils had been well removed. The lingual area, larynx and ears were normal. Treatment of the nasopharynx with astringents, followed by gentian violet, brought about marked improvement. After 10 treatments there were no complaints and the temperature remained normal. From July, 1934, to the present, the patient has remained afebrile and symptom-free except for four acute colds, with a recurrence of fever which subsided after several throat treatments.

This girl had evidently been subject to nasopharyngeal infections with a high degree of absorption each winter since childhood. Bed rest and general treatment did not enable her to overcome these attacks without local treatment, which was not administered until 1934, about seven years after her first illness. Although she still has infrequent recurrences, she responds to treatment quickly and suffers no serious incapacity nor interruption of activity.

Case 7: A man, age 36 years, entered Passavant Memorial Hospital (Hospital No. 27298) on July 27, 1936, complaining of a dry cough of two weeks' duration and malaise of three months' duration, the latter dating from a severe attack of nasopharyngitis which was accompanied by a fever of 104° and chills. He was uncertain as to the mode of onset of the cough, but felt that he might have had a slight fever at the same time, and knew that he had lost 10 pounds in weight.

The physical examination disclosed no significant abnormalities except edema, redness and mucoid discharge in the pharynx. The temperature on admission was 101°. Repeated examinations of the urine were normal. Four sputum examinations were negative for tubercle bacilli. The Wassermann test was negative. Blood count showed 5,630,000 erythrocytes per c.mm. of blood, 16.6 gm. of hemoglobin, 18,050 leukocytes,

of which 90 per cent were polymorphonuclear cells. A pharynx culture produced no B. diphtheriae or streptococcus hemolyticus, but a mixed growth, including staphylococcus albus, streptococcus viridans, neisseria catarrhalis, and escherichia coli.

At the time of admission there were no chest pains, but five days later the cough become painful and productive of rather copious amounts of greenish-colored, mucoid sputum, not tinged with blood. The possibility of lung abscess was considered.

Radiologic examination of the chest on Aug. 6, 1936, revealed only a deformity due to funnel breast, and a partially fixed left diaphragm, with evidence of pleural thickening just above it, and an old apical lesion at the right apex.

Direct examination of the sinuses at this time revealed no abnormality except some evidence of chronic involvement of the left maxillary sinus. X-rays of the sinuses made on Aug. 5, 1936, were reported as follows: "The frontal sinuses are symmetrical and normally aerated. The ethmoidals are apparently normal. The maxillaries show a normal right side, but on the left side there is a chronic thickening of the lining membrane of considerable grade. The sella turcica and the sphenoidals are normal. There is a little question of a possible osteoma in the superior ethmoidal cells anteriorly."

During the first two weeks in the hospital, the patient became worse, having a weight loss of six pounds, increasing pain in the chest and a temperature fluctuating between 99° and 102.4°.

I saw him first on Aug. 10, 1936, his fifteenth day in the hospital. At that time the nose and throat examination revealed the following findings: Structures of the nose were normal; free mucus in both sides of the nose; no purulent discharge noted. Nasopharyngoscopic examination revealed free mucopurulent discharge from the left posterior ethmoid. The vault of the nasopharynx was injected. The right lateral wall was markedly congested. The pharynx was inflamed. The lingual area and larynx were normal except for moderate congestion. Illumination of the sinuses was brilliant, and while the X-ray of the left maxillary showed some thickening, I felt that that had no bearing on the present complaint. A culture of the nasopharynx produced a moderate growth with a marked predominance of pneumococcus type IV.

Beginning three days later, the patient was given local treatments daily. Saline irrigations, neosilvol and dye were used, and an ice collar was applied to the patient's neck for short intervals each day. Three days later the patient felt much better and had a normal temperature. The left posterior ethmoid infection had completely subsided. Daily local treatments were continued, and his condition continued to improve, although he had marked local and general reactions following treatments. He began to gain weight, and there was a downward trend in the leukocyte count and the temperature.

The patient was discharged from the hospital on Sept. 6, 1936, with a leukocyte count of 11,200 and a temperature of 99.2°.

He was treated at the office on Sept. 11, 1936, and stated that he had had no fever since leaving the hospital. On Sept. 21, he had gained 10 pounds, and continued to have a normal temperature and no fatigue. On Oct. 13, he reported that he had gained 20 pounds since leaving the hospital. He had an acute cold at that time which was not accompanied by fever. His leukocyte count was 10,000. On Jan. 12, 1937, he visited the office for a final examination and culture. He had had no colds or "flu" since the last office visit. His leukocyte count and temperature had remained normal. There was no inflammation of the nasopharynx and the culture produced only rare colonies of neisseria catarrhalis, streptococcus viridans, and pneumococcus.

This patient suffered a severe illness, with symptoms suggesting a pulmonary involvement. While he had a definite posterior ethmoiditis left, this seemed to be a minor factor in comparison with the extensive nasopharyngeal infection. This opinion was in some measure confirmed by the fact that the patient responded so quickly to treatment directed only to the nasopharynx. No definite pulmonary condition developed and, because of the rapidity with which the pain subsided, it was concluded that it was probably an acute myalgia.

Further case histories would doubtless be tedious, but a consideration of the series as a group may serve to bring out additional information.

CLINICAL CONSIDERATIONS.

The 55 cases of nasopharyngeal infection have many features in common. When these patients present themselves, although they are not seriously ill, they are usually discouraged over the persistent elevation of temperature without any apparent cause, and frequently are alarmed lest it indicate tuberculosis, heart ailment, cancer, or some other very serious disease. The fatigue, which is entirely out of proportion to the activity, has reached a serious degree, in many instances leading to a curtailment of working hours, a change of occupation, or even a complete rest. A number of patients have taken a leave of absence for the purpose of building up general health by means of change of climate and complete relaxation, without permanent relief. In several cases a diagnosis of sinus infection had been made, but treatment of the area failed to lessen the fatigue and fever. The tonsils had been removed in a few cases with the hope that the symptoms would subside, but no appreciable change in the patient's condition resulted. Several patients had been under treatment for tuberculosis, although in none of these was the diagnosis confirmed upon complete study.

The three most common complaints, in addition to fever and fatigue, were headache, weight loss and muscle aching. Thirteen of the patients were known to have had a persistent leukocytosis, one a leukopenia.

The ages of the group varied from 5 to 57 years. Sixty-four per cent were between 20 and 40 years of age, 16 per cent were under 20 years of age, and 20 per cent were over 40 years of age.

Females constituted 81 per cent of the group; the clientele of the office is 64 per cent female. It would seem that fever

caused by nasopharyngitis, while somewhat more common in women between the ages of 20 and 40 years, is frequently found in people of both sexes and in a wide age range.

The duration of symptoms before patients were seen by us ranged from two weeks to seven years. Seventy-four per cent were known to have had fever for at least three months. The average duration was nine months.

PHYSICAL FINDINGS.

Forty-three of the 55 patients were referred by internists after having undergone very thorough physical examinations and laboratory studies. Many of them had received repeated examinations over a period of weeks or months, and were referred only after all other diagnostic possibilities were ruled out. My own study, therefore, consisted of examination of the ear, nose and throat area.

In all the patients except four there was no evidence of sinus infection. The turbinal mucosa appeared perfectly normal. No secretion was present in the region of the natural orifices of the accessory sinuses. Transillumination of the maxillary sinuses was brilliant. X-ray studies of sinuses, made in the majority of cases, were normal. Thirty-four of the patients had had tonsils cleanly removed. Eight had small tonsil tags which showed no evidence of infection. Thirteen showed evidence of chronic but slight infection of the tonsils. Twenty-five per cent showed hypertrophy of the lateral wall of the pharynx. The ears, structures of the nose and larynx were without significant abnormalities in all the cases.

Inflammation of the nasopharynx of varying degree was found. In many cases it was localized in the remains of the pharyngeal tonsil. In others, a diffuse inflammation of the whole nasopharyngeal area was present. A third group showed a localized inflammatory area on one wall or the other.

CULTURES OF THE AREA.

A cultural study in most of the cases confirmed the presence of definite infection. Cultures were obtained in the following manner: A sterile, cotton-wrapped metal swab, bent at approximately a 45° angle, was introduced into the naso-

pharynx without coming in contact with any other part of the mouth or throat. The medium used was 1.5 per cent agar prepared from fresh beef broth, Ph. 7.7, and mixed with sterile placental blood. A blood plate was streaked with the swab and immediately incubated at 37.5 C. It was examined at 24 and 48 hours, and transplants were made for the purpose of identification. Stained smears of the material obtained from the nasopharynx were examined in a number of cases. In only 3 per cent of them were any organisms found which did not correspond with those grown on the culture plates. Evidently the medium, temperature and oxygen supply met the growth requirements of most of the organisms in this area.

The predominating organisms in order of frequence were: Streptococcus viridans, neisseria catarrhalis, pneumococcus type IV, staphylococcus aureus, hemophilus influenzae, streptococcus hemolyticus and pneumococcus type III. Fifty-three per cent of the cultures produced a heavy growth, 33 per cent a moderate growth, and 14 per cent a slight growth. In 46 per cent of the cultures the growth consisted almost entirely of only one species of organism. The remainder showed a mixture of two or more of the above mentioned bacteria.

While the bacteriologic studies confirmed the clinical and physical findings in the majority of cases, they presented findings in some which did not coincide. For example, a few patients whose nasopharyngeal vaults appeared to be definitely infected showed only a slight growth on culture, and in some instances clinical and physical improvement was not accompanied by a decrease in the bacterial flora of the nasopharynx. Several explanations are possible. The infection in these cases may be due to an organism or virus which could not be obtained in culture by the method used. The infection may be situated deep in the tissue so that the responsible bacteria are not obtained in a culture taken from the surface. The symptoms may disappear when drainage is enhanced or absorption decreased, even though organisms still are present in large numbers. The cultures were particularly valuable in determining the type of treatment to be used, since dyes and other germicidal agents vary markedly in their effect on various bacteria.

TREATMENT.

The local treatment consisted of direct application to the involved area of a solution of silver nitrate of varying strength, depending on the degree of congestion, or, in some instances, of a weak solution of zinc sulphate. This was followed by generous application of a 2 per cent aqueous gentian violet solution or a 2 per cent solution of methylene blue. In cases which did not respond to the above treatment, a 0.5 per cent solution of colloidal iodine was used, followed by the dye. In cases where relief was not afforded by either of the above treatments, an autogenous filtrate was made, combined with a water soluble base, and applied directly to the area. Usually, during the course of local treatment, the patient was instructed to use saline irrigations and mildly antiseptic drops, such as silvol, neosilvol, or merthiolate. In 90 per cent of the cases the patients received no general treatment while they were under my care.

RESPONSE TO TREATMENT.

The number of treatments required to clear up the infection is somewhat dependent on the species of organism present. In most cases the focus was eradicated with from six to 12 treatments; all evidence of inflammation of the nasopharynx disappeared, the cultures were essentially negative, and the patients were free from fever and fatigue. Nine cases of the series of 55 failed to respond to treatment. Of course, those patients who do respond may be subject to reinfection with return of symptoms. In many of them any acute upper respiratory infection brings about a recurrence of fatigue and fever, which usually persists after the acute stage has passed, but which responds to treatment much more readily than the initial attack.

SUMMARY.

1. Fifty-five cases of fever and fatigue were found to have definite nasopharyngeal infection and no other significant abnormality.

2. Cultures taken from the area revealed the presence of large numbers of some pathogen in most of the cases.

3. Treatment of the nasopharynx resulted in eradication of the focus and relief of symptoms in approximately 80 per cent of the cases.

4. The method of treatment is discussed.

5. Reinfections brought a return of the symptoms, but yielded to treatment more readily than the initial attack.

6. Seven case histories are presented.

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700 North Michigan Avenue.

ATRESIA OF THE CHOANA. REPORT OF CASE.

DR. JOHN H. CHILDREY, San Francisco.

Obstruction of the choana is not an uncommon finding in the average nose and throat practice, for it may result from various causes, including large adenoids, hypertrophy of the turbinates, nasal polypi, tumors of the nasopharynx, foreign bodies and inflammatory conditions, such as syphilis and rhinoscleroma. Uncommon causes of such obstruction are developmental anomalies. Such a case is described here, which is of unusual interest because of its rarity and the difficulty of its correction.

In congenital atresia of the choana the obstruction may be bilateral, but is more commonly one-sided. The obstructing tissue may be membranous or bony, or a combination of both membrane and bone. Its occurrence is usually explained by the persistence of the nasobuccal membrane, which normally disappears at the end of the sixth week of fetal life; another theory of causation is that it results from persistence of the buccopharyngeal membrane, which separates the primitive mouth from the foregut, and still another theory is that of overgrowth or malposition of the bones entering into the structure of the choanae. No doubt various combinations of these factors may be instrumental in producing the obstruction. Stewart[2] believes that when bone is found in this atresia, it originates from overgrowth of the vertical and horizontal palatal processes.

The diagnosis is not difficult and may be made by use of the probe, nasopharyngeal mirror, Roentgenograms with radio opaque substances, and by the examining finger. Ordinarily a probe, carefuly used, is sufficient. Bilateral atresia is usually diagnosed soon after birth, when it becomes evident from the difficulty the infant has in nursing and in breathing that its nose is obstructed; however, the diagnosis may be missed and no doubt has been overlooked in cases of asphyxia neonatorum and in those mistakenly diagnosed as congenital cardiac con-

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ditions causing blue baby.[1] Cases of unilateral obstruction may go undiagnosed for years.

It is probable that early operation is best for cases of bilateral complete obstruction of the choanae, since nothing is to be gained by waiting, and the sooner the air passages are free the more likely are they and the adjacent structures to remain healthy. In unilateral cases, more delay is permissible since many patients breathe well enough through one side of the nose and indeed do not wish correction of the obstruction; however, the atresia should be corrected, because the resulting stagnation of the normal mucus in the affected nasal cavity in time will give rise to a pathologic condition of the lining membrane. When the obstruction is of bone it becomes more dense, owing to the sclerosis secondary to the inflammatory condition in the obstructed nostril.[2]

The experience of operators in the past has been that unless the posterior portion of the nasal septum, as well as the bony or membranous tissue obstructing the choana is resected, the cicatricial contraction of the new formed choana may occur. One must be careful to avoid the important blood vessels and nerves lateral to the choana and in the sphenopalatine canal. Postoperatively one must prevent the formation of, or remove, excessive granulations which tend to block the new opening and for this purpose rubber tubing, gauze strips or electrocoagulation have been employed.

CASE REPORT.

W. W., a girl, age 19 years, was examined Oct. 28, 1936, because of right sided nasal obstruction and a mucoid discharge from the right side of the nose, both present as long as she could remember. She stated that not quite a year previous she had undergone a submucous resection of the septum and the doctor found the right side of the nose closed with bone, which he removed. For a few days following this operation she could breathe through this side of the nose, but later it became obstructed again. She had used water for a while to irrigate the nose, but without benefit.

The patient was well developed, but overweight. The ear drums were normal in appearance. The larynx and vocal cords were normal. The teeth were in good condition, and the oral hygiene good. The left tonsil had been cleanly removed, but a small tag remained in the right tonsillar fossa. Posterior rhinoscopy was difficult, yet the nasopharynx appeared to be normal in size and conformation, and the Eustachian folds and orifices were normal. On digital examination both choanae felt identical, there seemed to be no obstructing membrane present, and the posterior septal border and margins of the choanae were defined without difficulty. Upon anterior rhinoscopy, it was apparent that a

submucous resection of the septum had been done, and that the right middle turbinate had been completely removed. This side of the nose was completely obstructed posteriorly by firm bony tissue. Pus was noted, discharging from the right posterior ethmoid region and there was considerable mucopus on the floor of the right side of the nose, a smaller quantity on the floor of the left side. Roentgenograms of the sinuses revealed a greyness of the ethmoid cells of both sides, and thickened membrane of the antra. A small quantity of mucopus was irrigated from the right antrum, a few small shreds from the left. The patient was advised to have the choanal atresia reoperated on, but her previous unfortunate experience decided her against this. She was seen again two weeks later, at which time she had had more trouble with the nose following swimming. The condition was the same, except for a more profuse nasal discharge.

COMMENT.

Had the posterior margin of the septum been removed and adequate attention been paid to the postoperative granulations, no doubt a successful result would have been attained, and the sinus infection possibly prevented or more easily relieved.

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1801 Bush Street.

THE USE OF SULFANILAMIDE IN ACUTE MASTOIDITIS. REPORT OF CASE.

DR. MAURICE VAISBERG, Patchogue, N. Y.

S. P., a boy, age 12 years, was seen in the office on March 27, 1937, complaining of pain in the right ear of about one week's duration and preauricular swelling of four weeks' duration. The previous history was negative except for scarlet fever at the age of 6 years. This was of moderate intensity and was complicated by a heart murmur, which cleared up in a short time.

Examination showed the boy to be acutely ill with an oral temperature of 101°. The right drum was red and bulging in its posterior portion. There was infiltration and tenderness of the right temporal muscle above the auricle, of the root of the zygoma and of the preauricular gland. Nasopharyngoscopic examination showed a moderate amount of adenoids and an acute rhinopharyngitis. The drum was incised with release of pus and blood.

On March 28, 1937, a call was made to the home. The following calls, except where noted, were all made to the patient's home. In the morning the patient had vomited and had felt a little chilly during the day. He complained of pain in the skin of the right side of the face and scalp, and also of a severe ache in the teeth on the right side. He was unable to open his mouth fully. The child appeared more washed out than on the previous day. Temperature was 103° rectally and pulse 110. There was a marked preauricular and parietal swelling extending 2 inches in front of the ear and 3 inches upon the scalp. There was a slight swelling of the postauricular area. The swollen areas were very tender, with the point of most exquisite tenderness at the root of the zygoma in front of the ear. The right deep cervical glands were enlarged and tender. There was a pulsating mucopurulent discharge from the right ear, which increased on jugular pressure and came through a nipple-shaped perforation in the lower part of the incision in the postero-

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inferior quadrant of the drum. The fundi and discs were within normal limits and no paralyses of the cranial nerves were evident.

Ear smears: Showed mucus, numerous polymorphs., but no bacteria. Blood count: W.B.C., 18,000. Differential: 82 per cent polymorphs., of these 6 per cent staff cells; nuclear index, 13.5; 17 per cent lymphocytes, and 1 per cent mononuclears.

At this time the impression gathered was that the patient had an acute purulent mastoiditis and very likely a zygomatic perforation. It was thought advisable to wait before operating because, according to the history, this was only the eighth day of the illness. Hospitalization was refused because of the economic status. Though no organisms could be demonstrated by smear and no culture was ever taken, it was thought advisable to try antistreptococcus serum in large doses and sulfanilamide (para aminobenzenesulfonamide), because previous experience indicated that most acute mastoid infections were due to hemolytic streptococci, especially so in rapidly spreading types of mastoiditis. The sulfanilamide was given in full adult doses, *i.e.*, three tablets (15 gr.) every four hours, six times daily; 10,000 units of State antistreptococcus serum was given into the left buttock after a negative intracutaneous test.

March 29, 1937: Patient appeared a little better. Rectal temperature was 102° and pulse was 105. The facial and parietal swelling was less, but the region was still quite tender. The drum and discharge were the same as on the previous day.

March 30, 1937: The swelling was less and tenderness had diminished. The rectal temperature was 102° and the pulse was 105; 10,000 units of antistreptococcus serum intramuscularly were given. The sulfanilamide was continued in full doses.

March 31, 1937: The swelling and tenderness of the face and parietal regions were considerably less. The drum still showed the same nipple-shaped perforation with a thick, profuse, pulsating mucopurulent discharge. The rectal temperature was 101° and the pulse was 100. The patient appeared pale and slightly cyanosed; 10,000 units of antistreptococcus

serum were given again and the sulfanilamide was reduced to two tablets every four hours, four times daily.

April 1, 1937: On this day, four days after sulfanilamide and serum therapy was instituted, the swelling was all gone. There was still slight tenderness of the zygoma, the drum bulged less, his color was improved, and he felt a lot better.

April 3, 1937: Rectal temperature was 99°. The patient looked a great deal better generally and his color was good. There was very slight tenderness over the zygoma. There was a moderate discharge from the ear and the point of perforation was less nipple-shaped and flatter.

April 5, 1937: Rectal temperature was 99°. A marked serum sickness with edema of the face developed on April 4, 1937, but subsided rapidly with the use of ephedrine by mouth. On this day there was less discharge and the perforation was still flatter.

April 7, 1937: The discharge was more mucoid and oozed through the drum. This visit was the second office visit. Temperature by mouth was 100°, but the pulse was 120. There was a systolic blow at the apex transmitted to the axilla, and a systolic blow over the pulmonic and aortic areas transmitted to the great vessels of the neck. A medical consultation was requested.

April 8, 1937: The medical consultant, after examination, suggested the possibility of a flare-up of the old heart condition, *i.e.*, endocarditis. He advised an increase in the dose of sulfanilamide.

April 9, 1937: The patient was again seen in the home, complaining of pains in the ankles, wrists, shoulders and fingers. Temperature was 100° rectally and pulse was 120. Examination of the eyes showed slight blurring of the disc edges. The right ear showed a pulsating discharge through the flat perforation. The heart, in addition to the murmur, presented a precordial thrill. Hemoglobin was 60 per cent (Sahli). The blood count showed W.B.C. 10,000.

Differential: 74 per cent polymorphs., of these 4 per cent staff cells; nuclear index, 19; 18 per cent lymphocytes; 2 per cent eosinophiles; 1 per cent basophiles, and 1 per cent mononuclears.

A blood culture was taken and proved to be sterile. At this time the exact diagnosis was in doubt. There might have been a lateral sinus thrombosis or phlebitis (right) with septicemia and endocarditis. Or there might have been present rhemuatic fever with endocarditis, or the heart might have been dilated because of toxemia or sulfanilamide.

April 10, 1937: Rectal temperature was 99° and pulse was 90. The heart murmurs were softer and less extensive. Sulfanilamide was continued in full doses.

April 11, 1937: Rectal temperature was 99° and pulse was 85. The patient still looked quite pale. The ear discharge was less. Sulfanilamide was reduced to 10 gr. four times a day.

April 13, 1937: The patient was vastly improved, especially as regards to color. Sulfanilamide was continued and hematinic medication was given.

April 16, 1937: Patient was considerably improved. Temperature was 99° rectally and pulse was 70. The color was almost normal, the heart murmurs were much fainter and there was a tiny bit of mucoid discharge from a minute perforation in the right drum. The sulfanilamide was reduced to 5 gr. four times daily.

April 23, 1937: This was the last time the patient was seen and the visit was at the office. The drum was completely healed, and the canal had a moderate amount of wax. There was a very soft blow over the cardiac area. The patient felt in good health and spirits, was gaining weight and had an excellent hemic component.

Several weeks later the medical consultant found that the cardiac condition had completely cleared and a personal report by the school nurse indicated that the patient was in the very best of health, without any complaint whatsoever.

COMMENTS.

Although the presence of hemolytic streptococcus was inferred from the clinical progress of the infection and from previous experience, its presence as a causative agent was apparently proved by the rapid therapeutic response to sulfanilamide.

A total of 1,200 gr. of sulfanilamide (80 gm.) was given in 28 days to a child age 12 years. This averaged 41.5 gr. (2.75 gm.) daily. The only evident ill effect might have been the heart manifestations, and the joint pains, but these came on during a period when the drug was being used in much reduced doses.

The remarkable rapidity in the diminution of perizygomatic swelling and the rapid flattening of the drum after the institution of sulfanilamide therapy changed the picture from one of an acute surgical mastoiditis to that of a rapidly resolving acute otitis media.

The part played by the antistreptococcus serum is difficult of evaluation, but it seems that the sulfanilamide, which was used for both the mastoid and the heart condition successfully, was the deciding factor in the favorable outcome.

Since this case, many patients with proven streptococcus infections of the middle ear, throat and larynx were treated intensively with sulfanilamide with no apparent immediate ill effects other than a moderate cyanosis. In one case there was a papulomacular rash and some nausea, which disappeared within a few hours after discontinuing the drug.

SUMMARY AND CONCLUSIONS.

A case of acute perforative zygomatic mastoiditis of probable hemolytic streptococcus origin with a secondary cardiac complication is presented. The intensive use of sulfanilamide combined with some antistreptococcus serum was effective in rapidly overcoming the mastoid infection and the apparent secondary cardiac complication. As a result of an experience with sulfanilamide in about 15 varied cases of streptococcus infection, it would seem that the drug can be pushed to the limits recommended (90 gr. daily) in adolescents and adults, provided that its administration is carefully supervised.

208 East Main Street.

TWO CASES OF STREPTOCOCCUS HEMOLYTICUS MENINGITIS WITH RECOVERY FOLLOWING USE OF SULFANILAMIDE.*

DR. DEAN E. GODWIN, Long Beach, Cal.

Among the recent advances in medicine, one that has achieved headline importance in both lay and medical publications is the use of sulfanilamide in streptococcic and other infections. Medical practitioners, bombarded as we are by enthusiastic detail men, each with a new and purportedly more wonderful drug than all his predecessors, are prone to grow skeptical and demand more than hearsay evidence before adopting a new therapeutic agent. But so many authentic cases have been reported in the past few months of the efficiency and well-nigh miraculous results of this new drug that it bids fair to be accepted as the outstanding medical achievement of the generation.

Introduced first in Europe under various trade names and later in this country as prontylin, the drug para aminobenzenesulfonamide, was acepted by the Council of Pharmacy and Chemistry of the A. M. A. as sulfanilamide in April of this year. It is made in 5 and 7½ gr. tablets by various firms for oral use. The red dye, the disodium salt of a closely related chemical is marketed by the Winthrop Chemical Co., in 2½ per cent aqueous solution for subcutaneous and intramuscular use under the name prontosil. There seems to be no need for intravenous injection, as the drug is quickly absorbed and appears in the urine in five hours after oral administration.

The drug first proved its efficiency in combating infections due to the beta hemolytic streptococcus, whether in localized or blood stream infections. Later reports seem to show it efficient in gonococcal, meningococcal and gas bacillus infections, and in one case of Type IV pneumococcus meningitis.

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It is in acute purulent diffuse leptomeningitis due to the beta hemolytic streptococcus that the use of sulfanilamide has been most astounding. The mortality in this condition has been so high that until this year the diagnosis of the condition has been almost synonymous to signing the death certificate. Within a few months a number of recoveries have been reported following the use of the drug.

The pioneering stage has not yet passed and much is yet to be learned as to dosage, and deleterious effects, particularly renal, blood changes, cyanosis, and pyrexia. Until more is known, it is felt that every case should be carefully studied and reported with laboratory findings.

The following case of meningitis following ethmoiditis with recovery has been under the care of the writer:

Case 1: E. R. G., a girl, age 16 years, weight 100 pounds. Previous history uneventful except for a tonsillectomy 10 years ago, with post-operative severe hemorrhage requiring transfusion.

July 6, 1937, following a mild sore throat, she developed marked pain above, behind and below the right orbit, with a temperature of 100°. She was examined July 7, at the office, and showed a moderate deviation of the septum to the right, with crowding in the region of the right middle turbinate, and some congestion and slight secretion in this region. Transillumination was somewhat less clear in the right than in the left, but there was no frontal or antral tenderness. The ears and throat were negative. A smear from the nasal secretion showed a few oval diplococci. She was treated conservatively with heat, local shrinking with ephedrine, empirin compound and a few doses of sulfanilamide.

That night she vomited three times and the temperature reached 102°. The next four days she was seen at her residence. The condition did not appear serious; the temperature gradually subsided, and there was no more vomiting. On July 12 and 14 she returned to the office for treatments. Except for slight frontal sinus tenderness, the condition seemed good. The nasal mucous membranes were shrunk with dilute cocaine and ephedrine, and mild radiatherapy treatments were given. Following this, the pain subsided, the nasal mucosa became nearly normal, but for several days there was some fever and she was again seen daily at her home. In a few days the temperature returned to normal and remained so for over 24 hours. On July 20, there was some swelling and marked bone tenderness in the midline of the forehead above the glabellar region and we had visions of a beginning osteomyelitis, but this soon subsided.

On July 22, 16 days after the first symptoms, the patient became hysterical, complained of severe frontal headache and had a temperature of 101°.

That night all symptoms became marked. She vomited repeatedly during the night. The temperature was 103.8°. She was semi-delirious and complained of severe headache.

On July 23, she was brought to Seaside Hospital and an internist, Dr. Smallwood, was called in consultation. X-rays showed the sinuses

on the right side slightly cloudy. The patient was semi-stuporous and moaning with severe headache. The neck was rigid, the pupils small and equal, and the fundi negative. There was a positive Kernig's sign, hyperactive knee jerks, negative Babinski. Otherwise physical examination was entirely negative. On spinal puncture, there was a cloudy fluid under increased pressure, with a cell count of 2,000, 98 per cent polys. Fehling's was not reduced; globulin was positive. No organisms were found. Blood count showed hemoglobin 80 per cent, reds 4,520,000, leukocytes 20,300, polys. 93 per cent. Intravenous glucose saline solution was given, moderate doses of barbiturates and prontosil 20 cc. during the day in 5 and 10 cc. doses, subcutaneously and intramuscularly. The patient lapsed into unconsciousness later in the day, but vomiting persisted. That evening a second spinal puncture was done, 30 cc. removed. No organisms were found. The urine was red.

July 24, second hospital day, at 3:15 A. M., the patient was apparently in extremis, stuporous, with Cheyne-Stokes respiration and marked retraction of the head. A spinal puncture showed a cell count of 5,000 and a few organisms, but culture from the first tap was positive for beta streptococcus hemolyticus. Prontosil was continued in 5 and 10 cc. doses, 40 cc. being given the second day. The temperature reached 105.4°.

In the evening, after being stuporous all day and after a total administration of 45 cc. of prontosil, she became conscious, rational and mentally alert. Spinal puncture showed a clearer fluid, with a 2,430 cell count. At this time a Rt VI N paralysis had developed and by the next day the left side was similarly involved, both external recti muscles being completely paralyzed.

From this time on, though the temperature remained high for several days, there was gradual improvement. Vomiting stopped and sulfanilamide by mouth was substituted for the prontosil injections and as high as 75 gr. a day were given, the dosage being gradually reduced as improvement took place. The patient still had severe headache and marked rigidity of the neck and retraction of the head. Daily spinal punctures were done (a total of 13), progressively clearer and with a progressively smaller cell count, and on July 30, the eighth hospital day, no micro-organisms could be found and the culture of the July 31 tap was negative. The temperature gradually subsided and became normal about August 2, the eleventh hospital day.

Three days after beginning the drug a dusky bluish-red discoloration of the skin appeared. It was not the color of a cyanosis from the lack of oxygen and did not diminish on administration of oxygen and carbon dioxide or of carbogen. It persisted until two days after the sulfanilamide was stopped, which was done on July 29, when the spinal fluid culture became negative. Spectroscopic examinations of the blood at this time were reported negative for the bands characteristic of sulfhemoglobin.

Laboratory tests were done for the concentration of sulfanilamide in the blood and spinal fluid.

One writer has stated that the concentration in the blood should reach 10 mg. per 100 cc. On July 27, a test of the spinal fluid showed 4.1 mg. per 100 cc. On July 29, the blood showed 8.55 mg. and the spinal fluid 6.75 mg. Four days after the drug was discontinued, tests for sulfanilamide in the blood and spinal fluid were both negative.

The blood throughout showed progressive anemia, which was controlled by four blood transfusions. The blood picture was otherwise normal until two days after the drug was discontinued, when poikilocytes, macrocytes, microcytes and nucleated reds were found. These had practically disappeared, however, in two or three days.

The urine was repeatedly examined. It became highly red colored within a few hours after the first administration of the prontosil, and the color promptly disappeared when sulfanilamide was substituted for prontosil. Otherwise there were no abnormal urinary findings except one day when acetone and diacetic acid were present in slight amounts.

The ocular paralysis in the right eye subsided within a few days. In the left, it has persisted much longer, but is showing gradual diminution on successive examinations and today slight diplopia and the slightly limited movement of the left eye are the only evident remaining effects of the infection.

Case 2: This case is presented through the courtesy of Dr. O. W. Grisier, of the U. S. Navy staff in Long Beach.

Mrs. E. S. F., age 37 years, was brought to Seaside Hospital, Aug. 3, 1937, by ambulance, just as Case 1 was recovering. She had had a moderate tonsillitis 10 days before, followed by earache in the right and spontaneous rupture of the right drum. The night previous the temperature had risen to 104.0° and she had become semiconscious.

Examination, on admission, showed a semicomatose patient with a temperature of 105.8°. The nose, throat, heart, chest and abdomen gave negative findings. The pupils were equal and reacted to light. There was a discharge from the right ear through a small perforation in the drum. There was no evidence of mastoiditis. The neck was rigid, the knee jerks absent. Roentgenograms showed a sclerotic mastoid on the right. Spinal puncture showed a cloudy fluid under pressure, with a cell count of 2,000. Globulin test was positive and Fehling's solution was not reduced. Streptococci were found in the smear, and on culture they proved to be of the hemolytic type. Urine showed a trace of albumin and sugar, and occasional casts. The blood examination showed 78 per cent hemoglobin, a red count of 4,370,000, a white count of 7.750 and 76 per cent polymorphonuclear cells.

Though the patient was semiconscious, she was able to swallow and sulfanilamide by mouth was started in 20 grain doses every four hours for five doses, then 15 grain doses for two more doses, a total of 130 grains being given in 24 hours. On the second day the highest temperature was 104.2°, and the patient became conscious and rational, and the spinal fluid count dropped to 1,200. On the third day the highest temperature was 101.8°, and the general condition seemed much improved, though there was still marked headache and neck rigidity, and the patient was irrational at times. The dose of the drug was reduced to 15 grains four times daily. On the fourth day the highest temperature was 100.6°; the patient was hungry and spinal fluid count was 750. The dose of the drug was continued at 15 grains but reduced to t.i.d. On the fifth day the maximum temperature was 100.0°, and culture of the spinal fluid and blood were negative.

On the sixth day the highest temperature was 99.0° and the next day it was normal and remained so. The dose of the drug was reduced to 5 grains t.i.d. On the twelfth day she was dismissed from the hospital, symptom free, and with a normal red blood count.

There had been no cyanosis or other toxic symptoms throughout the treatment.

SUMMARY.

Two cases are presented of severe diffuse leptomeningitis, the causative agent being the beta hemolytic streptococcus.

The prognosis in each under the previously best methods of treatment would have been perfectly hopeless.

Both were treated with heroic doses of the new drug, and both have made uninterrupted recoveries.

In Case 2, owing to the absence of vomiting, sulfanilamide was administered by mouth from the beginning, and in much larger doses. Whether due to this or to the difference in the severity of the infection, the drop in temperature and improvement in all symptoms were much more rapid than in Case 1.

REMARKS.

Dosage: The optimal dosage of the drug is not yet known. Long and Bliss have recommended, during the first 24 hours, of prontosil, 1 cc. for each pound of body weight; of sulfanilamide, ¾ gr. per pound body weight (1 gm. for each 20 pounds or 9 Kg.), the amount in either case to be greatly lessened after 24 hours or after maximum concentration is obtained.

It is recommended that in severe cases the doses be regulated by the laboratory reports as to the concentration of sulfanilamide in the blood or spinal fluid, and that the former be maintained at as near 10 mg. per 100 cc. as is possible.

As the drug is quickly absorbed, it is felt that intravenous or intrathecal administration is not necessary, and that unless in the presence of nausea or other contraindication, the oral administration of the sulfanilamide tablets is most effective. If contraindication to oral administration obtains, prontosil may be used, or better, a freshly prepared hot solution of sulfanilamide powder (0.8 gm. in 100 cc. normal saline). It is to be remembered that 100 cc. of prontosil is equivalent chemically to only 0.73 gm. or about 11 gr. of sulfanilamide, so there is a great discrepancy between the recommended dosages of the two drugs.

In the use of a drug that depends for its efficiency on the saturation of all body tissues, it is to be expected that toxic symptoms may become manifest. Already reports are coming in of various toxic manifestations, and more may be expected with the further use and abuse of the drug.

Cyanosis from the formation of sulfhemoglobin and methemoglobin has occurred frequently, the former seemingly caused or aggravated by the concurrent use of sulfate cathartics.

Blood changes, either a hemolytic anemia with destruction of the red cells, and the presence of nucleated and immature cells or an agranulocytosis from destruction of the white cells or toxic influence on the lymph forming organs, have been reported.

Mental confusion, headaches, neuritis of various kinds, including optic neuritis, have been noted.

Pyrexia has been common and may be difficult to distinguish from the fever of the original disease and only recognized by the drop of temperature on discontinuing the drug.

Nausea, acidosis, jaundice and disturbances of metabolism should be borne in mind as apt to occur.

Recently a number of cases of skin rashes, an itching maculopapular eruption with vesiculation, have been reported, the exposed surfaces being especially involved, and the condition being aggravated by sunlight.

These and possibly other yet unrecognized toxic manifestations should put us on our guard against the overenthusiastic and popular use of sulfanilamide, but should not deter us from carefully but boldly using it in such serious cases as these just mentioned.

820 Professional Building.

DEAFNESS IN THE COLLEGE AGE.

DR. M. MARTYN KAFKA, Brooklyn.

Deafness offers a great problem to the otolaryngologist for the reason that when a patient has a visual deficiency, lenses may be used to correct it; but when an individual has a hearing defect, he is very reluctant in having aids to hearing utilized.

The college individual certainly values the sense of hearing just as much, if not more, than the sense of speech and the sense of vision. When progressive deafness is experienced, an individual sooner or later isolates himself, because he or she will lose the sense of communication with the outer world. Most professional people, particularly those in the field of teaching, medicine, law and dramatics, value hearing more than any other group; and it is particularly for this reason that I wish to bring before the educational field the problem of recognizing a deficienecy in hearing at a very early age. Today, with the telephone, the vitaphone and the radio, hearing has become a very significant factor in the educational system. It is not only important for the school systems to recognize deficiencies in the auditory nerve early, but it is also wise on the part of the parents to bring their children for early diagnosis and treatment in diseases of the ear.

Among the causes for deafness as described may be acute infectious diseases, such as scarlet fever, measles, chickenpox, diphtheria, typhoid and pneumonia, as well as such complicating diseases as meningitis and encephalitis. There may be hereditary factors as deaf-mutism, either complete or partial, and also such conditions as otosclerosis, which is transmitted in particular strains of families where intermarriage may exist, or where there is a predisposition on the part of the deaf person predominant in his power to transmit the disease, marrying a person who also had a predominant characteristic in transmitting the disease, according to the laws of Mendel. In children where there are infected tonsils and

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adenoids as well as infected teeth, the likelihood of the foci of infection may be established and so the auditory nerve may be affected.

In certain children who are deaf, the cause is related to toxins which circulate in the blood from the intestines and from such foci of infection as from the teeth, tonsils, sinuses and adenoids. These foci of infections liberate toxins that have a definite injurious effect upon the extremely tender, delicate and highly attenuated mechanism in the internal ear. Drugs taken over a long period may also be a causative factor in the degeneration of the auditory nerve.

Middle-ear infections following complications of the acute infectious diseases, as whooping cough, acute serous otitis media, acute purulent otitis media, chronic purulent otitis media, acute mastoiditis, chronic mastoiditis, acute serous labyrinthitis and chronic labyrinthitis.

Some children may receive injuries to the hearing centres due to blows and falls, as acquired in athletic activities. In such cases the nature of these injuries may be either mild or severe. When it is associated with a fracture of the skull, the condition may lead to serious consequences, even terminating fatally.

In a statistical study quoted by Dr. Shambaugh, Jr., in 1920, he related that 45,000 deaf-mutes was the approximate number in the United States in that year, and that most of them acquired their deafness before the age of 8 years, so that they either lost their power of speech or never acquired the ability to talk. It is rather surprising to state that about 22,500 of this group were born deaf because the inner ear, the cochlea, never was fully developed. Of this group of 45,000, a third of the congenitally deaf children came from such families where a tendency to deafness seemed to exist.

Since most of these hearing deficiencies are actually caused up to about the age of 5 years, the parents should take particular measures in protecting their children against unnecessarily infecting them during this dangerous period.

To those individuals who enter the high grades of public school, high school and then eventually are admitted to college, their hearing is a great source of investment, and it is important that the auditory sense should be carefully and periodically checked at frequent and regular intervals. It is

interesting to note the characteristics associated with deafness in the college age group. I have followed histories very carefully in these cases and have observed that the majority have had some defect which may be attributed to the infections that they acquired early in their childhood days, which were partially or totally neglected. It is usually found that one ear is involved in the college group, and it is due to the fact that they rarely, if ever, suspect the nature of the disease. Ruling out the extraneous causes of deafness, such as cerumen in the canal and foreign bodies in the external auditory canal, the majority of students in college who are suffering from auditory defects definitely have a progressive deafness of either one or both ears.

There are a number of preventable diseases in the adult life, such as occupational deafness, as is found in people who are exposed to loud noises, steel riveters and people working around factories, where constant vibrations of shrieking sounds are present from machinery. Then there are cases due to syphilis. Some, however, are the otosclerotic types of deafness, which, indeed, is not preventable, since that is hereditary, and only through highly recognized eugenic measures can this serious condition be interdicted.

Recently, I have had the occasion to do some original work in following the testing of students in various universities. I am including in this study some of the important schools. In Cornell University the routine test in the physical examination conducted by the school physician for those who have deafness is to check by routine test, watch test, and then where there is any doubt, tuning forks, the whisper test, the conversation voice test and the coin check test are made in certain cases. At no time are soundproof rooms used in these tests. In using their watch test, the stopwatch is utilized, which is held at arm's length and can be heard by the normal ear. The whisper and the conversation tests are used where the watch test is defective.

In the routine examination of the students entering Cornell College at Ithaca, N. Y., there is from 2 to 3 per cent hearing deficienecy amongst them.

Yale University likewise, in conducting their hearing tests, has no soundproof rooms and in their routine tests use whisper and spoken words. In the most recent report it was

found that 153 students were observed who had defective hearing in a total of 5,317 students examined. These 153 students who had deficiency in hearing were further examined by the ear, nose and throat department to determine the degree of the deficiency present.

For several years the medical department of Princeton University tested the hearing of their students by the use of the whisper at a distance of 20 feet and also by the means of a watch. The medical department felt that these tests were inadequate and that the results were unreliable, even within the narrow field which they covered. However, during the past few years they have utilized the electric audiometer, which they feel is adapted to both the individual and for group examinations. The rooms in which these tests were made were not soundproof, although they were quiet.

The medical department at the University of Michigan also does not use soundproof rooms for hearing tests, although they would like to, but the expenditures would not permit it. The medical department after a thorough physical examination does not check the hearing unless a history of impaired hearing is given prior to entrance to college. When they do conduct the hearing tests on those who they feel require it, a watch test is not utilized, since they feel that it is not a fair test of hearing, but they have not obtained any statistical following as to the average defective hearing of the student body. In the conduction of their hearing tests they utilize the tuning forks and the audiometer. I was unable to obtain the percentage of deafness in the university.

I believe that at universities, college students should be given a rigid hearing test upon entrance and hearing tests should be conducted by otologists in a tolerably soundproof room. There should be every available type of instrument to conduct these hearing tests accurately, and all colleges should have a uniform classification of the hearing deficiencies encountered amongst the student body. Well-trained otologists should then treat all cases which are found to be deficient in hearing. The responsibility of the medical department statistics should not only be directed towards the physical qualifications, but to detect early such deficiencies in hearing which may be treated with some degree of satisfaction before the disease has become definitely chronic.

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HEARING TESTS IN AN IOWA COUNTY.

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Hearing tests in the State of Iowa have progressed so far that it is now possible to report results from testing one county seat and seven consolidated schools in the same county. The Board of Education of Boone, Iowa, engaged the services of the writer* to test pupils from the third grade through high school, and selected pupils in the lower grades. The superintendents of seven out of eight consolidated schools in the county engaged the writer later to test their schools. Thus Boone County became the first county in Iowa to have a large percentage of its school population tested. The results should be of interest to medical and educational officials who are interested in handicapped school children.

Boone County is in the north central part of Iowa, in a rich agricultural region. Farmers are prosperous, have good homes and are "health conscious." Boone is a division point for the Northwestern Railroad and is a shopping centre for many miles around. The city of Boone has had health service for many years, although this was dropped for several years during the depression and restored two years ago. At present a full-time school nurse gives routine public health service. Inoculations and tests for tuberculosis, smallpox, Schick tests, etc., have been made in large numbers. Tonsillectomies range in the elementary buildings from 20 per cent to 40 per cent of the population. The pupils in the consolidated schools are more than 50 per cent rural. In one school, 95 per cent are from farmers' homes. One town, Madrid, is a coal mining centre, with over 75 per cent of its children from miners' homes. The health of this centre is protected by a community physician. Three of the consolidated schools have no health service. The others have an itinerant nurse who visits one or two days twice a month. Tonsillectomies in the consolidated schools range from 21 per cent to 34 per cent of the school population.

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The examiner used the 4-A audiometer to test all pupils. Pupils from the 2-B grade up were tested in groups. A third and individual test was given to those who failed two group tests. These were tested singly with the 4-A audiometer, the pupils repeating the numbers they heard while the examiner wrote them on the test chart. The selected pupils in the kindergarten, first and second grades of Boone were also given the individual test; likewise all first grade pupils of the consolidated schools. (A detailed description of the individual test is given in the *Volta Review* for April, 1937.)

The examiner was assisted by the school nurse and an assistant who was either a teacher, a parent or a senior in high school. A quiet room on the top floor was selected to which all groups were brought for the tests. The entire school staff had been organized in advance of the examiner's arrival in order to maintain quiet. Univents, clocks and noisy ventilating fans were stopped. Children were allowed to pass through the halls only when necessary and then on tiptoe. Teachers and principals were asked to take the test so that they would appreciate the necessity for quiet. This clinched that matter for the rest of the program.

Criterion for reporting hearing defect was 6 dcb. Those who could not hear below this point were listed as having hearing defects. This is in accordance with suggestions of Fowler, Hayden and Newhart, in order that results from different parts of the country can be fairly compared. The examiner replayed one column of the record if a sudden outside noise disturbed the children.

Eight days were required to test the 1,917 pupils in Boone, located in seven grade buildings and a junior-senior high school. The 590 junior high pupils were tested in one day; 555 senior high pupils were tested on the second day, and the retests for both groups were given on the morning of the third day. The seven grade buildings were tested in five and one-half days. The consolidated schools were tested in nine days, Madrid and Luther requiring two days each.

Table I shows that 1,611 pupils in the consolidated schools in all grades were tested. The number of pupils showing a hearing loss was 93, or 5.8 per cent. In Boone, tests of 1,868 pupils from the third grade through high school showed 94, or 5 per cent deficient. Forty-nine pupils from the kindergarten, first and second grades in Boone also were selected

for indivdiual tests. Eleven of these were found deficient in hearing. The percentage of deficient pupils among the unselected groups of the county was 5.4. The consolidated

TABLE I.

SUMMARY OF HEARING TESTS IN BOONE COUNTY, IOWA.

Town Consolidated Schools—	Pupils Tested	Pupils Failed	Per Cent Failed
Beaver	58	4	6.8
Boxholm	185	10	5.4
Jordan	160	11	6.9
Luther	182	10	5.5
Madrid	514	32	6.2
Ogden	387	21	5.4
Pilot Mound	125	5	4.0
Total	1,611	93	5.8
Boone (3rd-12th)	1,868	94	5.0
Total unselected pupils	3,480	187	5.4
Boone (selected pupils)	49	11	
Totals	3,529	198	

TABLE II.

CLASSIFICATION OF HEARING DEFICIENT PUPILS ACCORDING TO LOSS IN THE WORSE EAR.

Hearing Loss	Number of Pupils Consolidated Schools	Boone Schools	Total All Schools
6 dcb.	35	35	70
9 dcb.	23	31	54
12 dcb.	11	6	17
15 dcb.	7	9	16
18 dcb.	3	6	9
21 dcb.	2	6	8
24 dcb.	3	6	9
27 dcb.	2	3	5
30 dcb.	1	0	1
36 dcb.	0	2	2
42 dcb.	2	0	2
45 dcb.	2	1	3
51 dcb.	1	0	1
57 dcb.	1	0	1
Totals	93	105	198

schools showed only 0.8 per cent greater incidence than the Boone (city) schools.

Table II classifies the pupils according to the hearing loss in the worse ear. This method was used to demonstrate to

parents and educators how severe the hearing loss could become in a child's ear. Of course, some of these children had one normal ear; others had 3 dcb. or 6 dcb. or 9 dcb. loss in the opposite ear. It is seen that 70 pupils were found with 6 dcb. loss in at least one ear, 54 with 9 dcb. loss and 17 with 12 dcb. loss in the worse ear. The balance of the 198 with hearing deficiencies, or 57, were found with a hearing loss in one ear that ranged from 15 dcb. to 57 dcb., which was the limit of the audiometer. That 28.8 per cent (57 out of 197) had a loss of about one-sixth or greater in one ear is a significant fact for educators and parents.

TABLE III.

CLASSIFICATION OF HEARING DEFICIENT PUPILS WITH LOSS OF AT LEAST 6 DCB. IN BOTH EARS.

Hearing Losses:	Number of Pupils Consol.	Boone	Total
6 dcb. loss in better ear, 6 dcb. or greater, other ear..	11	16	27
9 dcb. loss in better ear, 9 dcb. or greater, other ear..	4	3	7
12 dcb. loss in better ear, 12 dcb. or greater, other ear..	4	3	7
15 dcb. loss in better ear, 15 dcb. or greater, other ear..	2	2	4
18 dcb. loss in better ear, 18 dcb. or greater, other ear..	1	1	2
21 dcb. loss in better ear, 21 dcb. or greater, other ear..	1	1	2
33 dcb. loss in better ear, 33 dcb. or greater, other ear..	–	1	1
Total	23	27	50

Table III classifies pupils who had a hearing loss in both ears of 6 dcb. or better. A pupil with a loss of 6 dcb. in his right ear might have a loss as great as 100 dcb. in the other ear, but the important fact is to know how well the handicapped pupil can hear out of his better ear, when both ears are deficient. Thus, 27 had a hearing loss of 6 dcb. in the better ear and 6 dcb. or greater loss in the other ear; seven had a loss of 9 dcb., seven had a loss of 12 dcb., nine had a loss of 15 dcb. or greater in the better ear. In order to show the degree of their handicaps, the losses of the last nine are listed here:

15 dcb. loss in right ear, 18 dcb. loss in left ear.....1
15 dcb. loss in right ear, 24 dcb. loss in left ear.....1
15 dcb. loss in right ear, 36 dcb. loss in left ear.....1
15 dcb. loss in right ear, 45 dcb. loss in left ear.....1
18 dcb. loss in right ear, 18 dcb. loss in left ear.....1
18 dcb. loss in right ear, 27 dcb. loss in left ear.....1
24 dcb. loss in right ear, 21 dcb. loss in left ear.....1
24 dcb. loss in right ear, 24 dcb. loss in left ear.....1
33 dcb. loss in right ear, 36 dcb. loss in left ear.....1

A most significant fact to be learned from Table III is that 50 pupils, or one-quarter of the 198 found deficient, have a hearing loss in both ears. The educator is interested especially in these children. He seeks information on the possibility that some of these may become more seriously handicapped in future years unless immediate corrective measures are applied. He also wants to know how many of them are permanently handicapped in order that they may be given a better opportunity to progress to the best of their abilities. That the nine listed separately above had at least a 15 dcb. loss in the better ear indicates how seriously the handicap has already become among almost one-fifth of these pupils.

TABLE IV.

CLASSIFICATION OF DEFICIENT HEARING PUPILS ACCORDING TO SCHOOL GRADES.

Grade	Consolidated Schools			Boone Schools			All Schools		
1	131	9	6.9	—	—	—	131	9	6.9
2	107	5	4.7	—	—	—	107	5	4.7
3	117	5	4.3	166	6	3.6	283	11	3.9
4	116	6	5.1	187	7	3.7	303	13	4.3
5	108	11	10.2	187	11	5.9	295	22	7.4
6	143	9	6.3	183	11	6.0	326	20	6.1
Total	722	45	6.2	723	35	4.9	1,445	80	5.5
7,8	265	14	5.3	590	32	5.4	855	46	5.4
9-12	624	34	5.4	555	27	4.9	1,179	61	5.2
Total	1,511	93	5.8	1,868	94	5.0	3,479	187	5.4

Table IV classifies the deficient hearing pupils according to school grades. The percentages in the elementary, junior and senior high groups are 5.5 per cent, 5.4 per cent, and 5.2 per cent, respectively. The incidence in these groups is so close that it must be considered just as important to test the high school groups as it is to test the elementary. This point is mentioned because some school officials believe that it is not necessary to test the high schools. Incidentally, many high schools are not included in the public school nursing service.

Table V gives the history of pupils who were found with deficient hearing. Their parents had filled in questionnaires brought home several days prior to the arrival of the examiner. The replies, hence, should be considered reliable enough for consideration. Out of the 198 pupils, only 15, or 7.6 per

cent, reported no history of ear trouble. In addition, at the time of the test they were found with no apparent physical defects which might account for a hearing loss. One hundred seventy-three, or 92.4 per cent, showed histories of ear trouble recently or in the past. And 54.5 per cent of the cases reported ear aches, 31.3 per cent running ears, 22.2 per cent reported ear noises. A total of 85, or 43 per cent, of the defective pupils were found to possess enlarged or diseased tonsils and adenoids. Finally, 29, or 14.6 per cent, had wax occlusions in one or both canals.

TABLE V.

HISTORY OF PUPILS WITH DEFICIENT HEARING, AS REPORTED ON QUESTIONNAIRES OR FROM PHYSICAL EXAMINATIONS.

What they reported:	Number Reporting	Per Cent Reporting
No ear trouble	15	7.6
Ear trouble	173	92.4
Ear aches, past or present	108	54.5
Running ears, past or present	62	31.3
Ear noises	44	22.2
Defective, enlarged tonsils or adenoids	85	43.0
Wax occlusions	29	14.6

From an examination of the results of a hearing survey conducted in an Iowa county, we must conclude that the hearing of children in the rural consolidated schools is as good as those who are in the city schools. Some factors responsible for this may be "4-H Club" health activities, the general "health consciousness" of the farming population and the better economic status of the rural population in this county. Whatever the factors, the incidence of hearing defect in the county population outside the county seat is well below incidences reported for other parts of the United States.

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